

## **MARCELLUS SHALE DEVELOPMENT**

### **MARCELLUS SHALE FORMATION**

The Marcellus Shale is a rock formation that underlies approximately two-thirds of Pennsylvania and portions of the states of New York, Ohio, West Virginia, Maryland, Kentucky and Virginia. The Marcellus Shale holds trillions of cubic feet of natural gas that had long been considered prohibitively expensive to access. Advances in drilling technology and natural gas extraction, however, have attracted new interest in this previously untapped formation. The geology and drilling trends within the Marcellus Shale suggest that areas in the southwest, north-central and northeastern regions of Pennsylvania may be especially productive. The most productive interval of the Marcellus Shale occurs at a depth of 5,000 to 8,500 feet below the ground surface, or roughly more than a mile.

### **NATURAL GAS EXTRACTION FROM THE MARCELLUS SHALE**

Efficiently extracting natural gas from the Marcellus Shale formation requires both vertical and horizontal drilling, combined with a process known as ‘hydraulic fracturing,’ or ‘fracing.’ After the well is drilled, cased and cemented to protect groundwater and prevent the escape of natural gas and other fluids, drillers pump large amounts of water mixed with sand and other fluids into the shale formation under high pressure to fracture the shale around the well, which allows the natural gas to flow freely to the wellbore. The amount of water typically required for hydraulic fracturing ranges from about one million gallons for a vertical well to approximately five million gallons for a vertical well with a horizontal lateral segment.

Once the hydraulic fracturing process is completed, the used water, often referred to as “flowback,” is reused in the next well, injected in deep underground disposal wells or sent to an approved treatment facility.

### **LANDOWNERS AND MARCELLUS SHALE LEASING**

In order to access Marcellus Shale natural gas, drilling companies must enter into a lease with landowners. A mineral lease is a private contractual agreement between the owner of a mineral tract (the lessor) who grants the right to develop deposits of the mineral to a producer (the lessee). Oil and gas mineral rights can be sold or leased separately to different parties. Usually a lessee will insist on the right to sell or reassign a mineral lease to another party. Because a mineral lease gives the lessee a property interest in the mineral, leases should be recorded at the Recorder of Deeds office in the county where the leased tract is located. A lease is usually secured by annual rental payments or a royalty on production paid to the lessor. Lease payments, royalty amounts; well, road and pipeline locations; protections for crops, livestock, buildings, personal property and the expiration date of the lease can be negotiated.

The commonwealth is not involved in regulating/negating lease agreements between mineral property owners and producers, and does not audit payments, read or calibrate meters or tanks, or otherwise get involved in lease matters.

If approached by a drilling company about leasing mineral rights on personal property, consult an attorney who is familiar with oil and gas law before signing any documents. Consider contacting the local bar association for assistance in finding an attorney in the area, if necessary.

The Penn State University Cooperative Extension conducts gas leasing workshops for landowners. A schedule of upcoming workshops and other leasing information can be found at [extension.psu.edu/naturalgas](http://extension.psu.edu/naturalgas) or by contacting the local extension office.

### **REGULATION OF MARCELLUS SHALE DRILLING**

More than 350,000 oil and gas wells have been drilled in Pennsylvania since the first commercial oil well was developed in 1859 by Colonel Drake in Titusville. Oil and gas exploration is regulated under the state’s oil and gas laws (Oil and Gas Act, Coal and Gas Resource Coordination Act, and Oil and Gas Conservation Law), and the environmental protection laws that include the Clean Streams Law, the Dam Safety and Encroachments Act, the Solid Waste Management Act, and the Water Resources Planning Act.

## WELL DRILLING ACTIVITIES

The Department of Environmental Protection (DEP), Office of Oil and Gas Management regulates the safe exploration, development and recovery of Marcellus Shale natural gas reservoirs in a manner that will protect the state's natural resources and the environment.

To drill a new Marcellus Shale natural gas well in Pennsylvania, the operator must obtain a well permit from DEP and post a bond. The bond is a financial incentive to ensure that the operator will adequately perform the drilling operations, address any water supply problems the drilling activity may cause, reclaim the well site, and properly plug the well upon abandonment. In accordance with established requirements under Act 13 (the 2012 Oil and Gas Act), bond amounts vary depending on the number of wells an operator plans on drilling. All wells drilled in the Marcellus Shale have total wellbore lengths of at least 6,000 feet and the bond amounts for wells of that length are as follows or up to 25 wells, the bond amount is \$10,000 per well, but may not exceed \$140,000. For 26 to 50 wells, the bond amount is \$140,000 plus \$10,000 per well, but may not exceed \$290,000. For 51 to 150 wells, the bond amount is \$290,000 plus \$10,000 per well, but may not to exceed \$430,000. Finally, for more than 150 wells, the bond amount is \$430,000 plus \$10,000 per well, but may not to exceed \$600,000. The Oil and Gas Act also has provisions for filing blanket bonds as an alternative to bonding individual wells.

In the Marcellus Shale natural gas well permit application, the applicant must show the location of the well and consider proximity to workable coal seams, gas storage reservoirs, landfills, surface waters and water supplies. Technical staff in DEP's regional offices review the permit application to determine whether the proposed well would cause environmental impacts, conflict with coal mine operations, or violate any applicable well spacing requirements. Permit review staff also ensure that all proper notifications and clearance letters have been obtained. Operators must submit reports on well completion, waste management, semi-annual production and well plugging.

Pennsylvania law requires drillers to case and cement Marcellus Shale natural gas wells through all fresh water aquifers before drilling through deeper zones known to contain oil, gas or brackish water. The casing and cement protects groundwater from the fluids and natural gas that will be contained inside the well, and keeps water from the surface and other geologic strata from mixing with and contaminating groundwater.

Disruption of water quality or flow in water wells from drilling activities is rare and generally temporary. However, if problems persist, state law requires drilling operators to replace or restore water supplies affected by drilling. If an individual is not satisfied with the drilling company's response, a complaint can be filed with the nearest DEP regional office. DEP will investigate complaints within 10 days and issue orders as necessary to replace or restore the water supply. Marcellus Shale operators are presumed responsible for any water supply impacts that occur within 2,500 feet of the vertical wellbore section and within a year of drilling, stimulation, completion or alteration activities.

DEP's Office of Oil and Gas Management has instituted requirements for mechanical integrity testing of all operating oil and gas wells, including Marcellus Shale wells, effective the fourth quarter of 2013. The regulation requires the submittal of quarterly well integrity inspection reports for all operating wells on an annual basis on or before Feb. 15 of the year following the inspections. The reports must be submitted electronically through DEP's online reporting application at [www.depgreenport.state.pa.us](http://www.depgreenport.state.pa.us).

Operators of wells permitted to produce from the Marcellus Shale formation are required to submit a production, waste and well status report to DEP semi-annually on or before Feb. 15 and Aug. 15 of each year. The report due on Feb. 15 shall include all information for the first time period from July 1 through Dec. 31 of the preceding year. The report due on Aug. 15 shall include all information for the time period from Jan. 1 through June 30 of that year. The reports must be submitted electronically through DEP's online reporting application which can be accessed at [www.paoilandgasreporting.state.pa.us](http://www.paoilandgasreporting.state.pa.us).

Once a well is no longer producing, the operator must plug the well and restore the site within nine months of plugging the well.

Many landowners and municipalities are interested in receiving notice of well permit applications. DEP has a no-cost subscription service called eNotice that notifies landowners and municipalities with an email when a well permit application is received. This system enables landowners and municipalities to receive notice of a permit application at the same time that DEP receives the application. eNotice can be accessed through DEP's website at [www.dep.state.pa.us](http://www.dep.state.pa.us), keyword: eNOTICE.

## **EARTH DISTURBANCE ACTIVITIES**

Marcellus Shale natural gas well development involves extensive earth disturbance including roads, drilling pads and pipelines that can result in accelerated erosion and sedimentation.

Various regulations, implemented through DEP, are in place to protect surface water and groundwater from accelerated erosion and sedimentation due to earth disturbances. Erosion and Sediment Control requirements under state law apply to any earth disturbance associated with oil and gas activities, which includes Marcellus Shale natural gas development (Pa. Code Chapter 102). For all oil and gas activities, the operator must use preventative measures known as Best Management Practices (BMPs) to control erosion and sedimentation. The BMPs must minimize the potential for accelerated erosion and sedimentation.

Oil and gas operators proposing earth disturbance activities must develop and implement a written Erosion and Sediment Control Plan (E&S Plan) when earth disturbance activities will result in total earth disturbance of 5,000 square feet or more or if the earth disturbance activity has the potential to discharge to water classified as High Quality or Exceptional Value water (Chapter 93).

Erosion and sediment plans require gas companies to use BMPs to prevent accelerated erosion and sedimentation and to minimize earth disturbance, soil compaction and increased stormwater runoff.

For oil and gas activities, including Marcellus Shale development, that disturb more than five acres over the life of the project, an Erosion and Sediment Control General Permit must be obtained prior to commencing earth disturbance. A Notice of Intent, the Erosion and Sediment Control Plan and a site restoration or post construction stormwater management plan must be submitted to DEP for review and approval.

## **WATER USE AND WASTEWATER DISPOSAL ACTIVITIES**

Large volumes of water are required to complete a Marcellus Shale natural gas well, and large volumes of waste water are generated as part of the process. This wastewater is considered industrial wastewater and is a residual waste in Pennsylvania. DEP, in cooperation with the Susquehanna and Delaware River Basin Commissions, has created additional permit guidelines for drilling in the Marcellus Shale formation to create consistent rules for water withdrawal, usage, treatment and disposal in all areas of the state, and to ensure that the water quality and uses of waters of the commonwealth are not threatened by drilling operations.

As part of the permit application process, drilling companies must develop a Water Management Plan to identify where they plan to obtain and store the water, identify withdrawal quantity, rate, timing and pass by flow requirements. When applying for a permit, drillers must specify the sources withdrawal locations and demonstrate that the proposed withdrawal will not adversely affect quantity or quality for other uses or users, maintain designated and existing uses of the source water body, cause no adverse impacts to water quality in the watershed as a whole and include a reuse plan for water used to hydraulically fracture wells. If necessary, approval from the appropriate River Basin Commission must also be obtained. Pits or impoundments with an embankment used to temporarily store water for drilling activities must meet DEP standards for construction and may also require a DEP dam permit.

Drilling companies must also identify where produced wastewater will be stored, treated and disposed. Pits or impoundments with an embankment for temporarily storing drilling wastes must meet DEP standards for construction (e.g., synthetic liners) and may also require a DEP dam permit.

Wastewater (fluids) must be recycled, treated at an authorized wastewater treatment facility, or disposed at an authorized waste disposal facility. DEP approval is required before the receiving treatment or disposal facility can accept the wastewater for processing and/or disposal.

## **MONITORING**

DEP inspects well sites from construction to reclamation to ensure that the site has proper erosion controls in place, and that any waste generated in drilling and completing the well was properly handled and disposed. Also, well operators are required to submit a variety of reports regarding well drilling, completion, production, waste disposal and well plugging. When called for, DEP employs aggressive enforcement against well operators to ensure that facilities are brought into compliance.

DEP field operations staff inspects well sites to ensure that the operator sites and drills the well according to the permit and applicable laws. DEP staff also investigate complaints where an oil or gas well or drilling activity may be causing environmental or public safety concerns, especially when contamination of a drinking water supply is suspected.

**COMPLIANCE ASSISTANCE**

In addition to permitting and enforcement, DEP works to instruct and advise well drillers and operators on BMPs and procedures for environmental control and waste management. Compliance assistance helps to prevent incidents of environmental degradation. DEP holds workshops for the industry and will meet with applicants as needed to address environmental matters in advance of well site construction.

For more information about oil and gas drilling and production in Pennsylvania, visit [www.dep.state.pa.us](http://www.dep.state.pa.us), keyword: oil and gas, or contact one of the following offices.

PA Department of Environmental Protection  
Bureau of Oil and Gas Planning & Program Management  
 P.O. Box 8765  
 Harrisburg, PA 17105-8765  
 Phone: 717-772-2199 Fax: 717-772-2291

PA Department of Environmental Protection  
North-central Regional Office - Eastern District  
 Oil and Gas Management Program  
 208 West Third St.  
 Williamsport, PA 17701-6448  
 Phone: 570-327-3636 Fax: 570-327-3420

PA Department of Environmental Protection  
Southwest Regional Office  
 Oil and Gas Management Program  
 400 Waterfront Drive  
 Pittsburgh, PA 15222-4745  
 Phone: 412-442-4024 Fax: 412-442-4328

PA Department of Environmental Protection  
Northwest Regional Office  
 Oil and Gas Management Program  
 230 Chestnut St.  
 Meadville, PA 16335-3481  
 Phone: 814-332-6860 Fax: 814-332-6121



# Oil and Gas Districts

