

UNCONVENTIONAL SHALE DEVELOPMENT

UNCONVENTIONAL SHALE FORMATIONS

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 and other unconventional formations (Utica, Rhinestreet, Burket, etc.) hold hundreds of trillions of cubic feet of natural gas that had been considered prohibitively expensive to access until about 15 years ago. Advances in drilling technology and natural gas extraction, however, have attracted interest in these resources, which are now responsible for the majority of gas production in Pennsylvania. 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. The Rhinestreet and Burket Shales are shallower than the Marcellus, and the Utica Shale is significantly deeper.

NATURAL GAS EXTRACTION FROM UNCONVENTIONAL SHALE FORMATIONS

Efficiently extracting natural gas from unconventional formations requires both vertical and horizontal drilling, combined with a process known as ‘hydraulic fracturing,’ or ‘fracking.’ 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 ten- to thirty-million gallons depending on the length of the 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 UNCONVENTIONAL SHALE LEASING

In order to access natural gas from unconventional shale formations, drilling companies may 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 or negotiating 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.

Landowners approached by a drilling company about leasing mineral rights on personal property should 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 <https://extension.psu.edu/naturalgas> or by contacting the local extension office.

REGULATION OF UNCONVENTIONAL SHALE DRILLING

Recent research suggests that somewhere between 300,000 and 760,000 oil and gas wells have been drilled in Pennsylvania since the first commercial oil well was developed in 1859 by Colonel Edwin Drake in Titusville. Oil and gas exploration is regulated under the state’s oil and gas laws (2012 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. The commonwealth’s primary regulations for unconventional well development are located at 25 Pa. Code Chapter 78a, <https://www.pacodeandbulletin.gov>.

WELL DRILLING ACTIVITIES

The Department of Environmental Protection (DEP), Office of Oil and Gas Management regulates the safe exploration, development, and recovery of natural gas reservoirs in unconventional formations in a manner that protects public health, public safety and the environment.

To drill a new unconventional 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 impacts the drilling activity may cause, reclaim the well site, and properly plug the well upon abandonment. In accordance with established requirements under the 2012 Oil and Gas Act, bond amounts vary depending on the number of wells an operator plans on drilling in the state. All unconventional wells that have total wellbore lengths of at least 6,000 feet must post bond amounts as follows: For up to 25 wells, the bond amount is \$10,000 per well, but may not exceed \$140,000 total. For 26 to 50 wells, the bond amount is \$140,000 plus \$10,000 per well, but may not exceed \$290,000 total. For 51 to 150 wells, the bond amount is \$290,000 plus \$10,000 per well, but may not exceed \$430,000 total. Finally, for more than 150 wells, the bond amount is \$430,000 plus \$10,000 per well, but may not exceed \$600,000.

In the unconventional 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 district 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, monthly production, and well plugging.

Pennsylvania law requires drillers to case and cement unconventional 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 uncommon and generally temporary. However, state law requires drilling operators to replace or restore water supplies affected by drilling. A complaint may be filed with the DEP district office responsible for the county where the water supply is located (see map). DEP will investigate complaints within 10 days and issue orders as necessary to replace or restore the water supply. Unconventional well 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 unconventional wells. Pennsylvania was the first state to introduce such a comprehensive program and is one of only two states that have such requirements. The regulation requires the submittal of quarterly well integrity inspection reports for all operating wells on an annual basis on or before February 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.

Operators of unconventional wells are required to submit a production, waste, and well status report to DEP monthly 45 days after the end of the monthly reporting period. For example, the December monthly report is due by February 14. The reports must be submitted electronically through DEP's online reporting application which can be accessed at www.paoilandgasreporting.state.pa.us/publicreports/Modules/Welcome/Agreement.aspx.

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.pa.gov.

EARTH DISTURBANCE ACTIVITIES

Unconventional 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 unconventional well development (25 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).

E&S 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 unconventional well 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 E&S 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 an unconventional well, and large volumes of wastewater 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 guidelines for drilling in the Marcellus Shale and other unconventional formations 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.

A person may not withdraw or use water from water sources within this commonwealth for drilling or hydraulic fracture stimulation of any unconventional well except in accordance with a Water Management Plan (WMP) approved by DEP. In a WMP, a person identifies where a person plans to obtain and store the water and identifies withdrawal quantity, rate, timing, and pass-by flow requirements. A person must specify the withdrawal locations of source water and demonstrate the following: proposed withdrawal will not adversely affect quantity or quality for other uses or users, designations and uses of the source water body will be maintained, water quality in the entire watershed will not be adversely impacted and a reuse plan for water used to hydraulically fracture the wells will be provided.

Unconventional well operators must also identify where produced wastewater will be stored, treated, and disposed.

Wastewater (fluids) must be recycled, treated at an authorized wastewater treatment facility, or disposed at an authorized waste disposal facility.

MONITORING

DEP inspects unconventional 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, unconventional well operators are required to submit a variety of reports regarding well drilling, completion, production, waste disposal, and well plugging. If necessary, DEP employs aggressive enforcement against well operators to ensure that facilities are brought into compliance.

DEP also inspects unconventional well sites to ensure that the operator sites and drills the well according to the permit and applicable laws. DEP staff investigate complaints where an unconventional well or drilling activity may be causing environmental or public safety concerns.

COMPLIANCE ASSISTANCE

In addition to permitting and enforcement, DEP works to instruct and advise unconventional well drillers and operators on BMPs and procedures for environmental control and waste management. Compliance assistance helps to prevent incidents of environmental degradation. DEP periodically holds workshops for 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.pa.gov or contact one of the following offices.

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

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

