



Drilling for Natural Gas in the Marcellus and Utica Shales: Environmental Regulatory Basics

January 2014

Introduction

This fact sheet provides a basic overview of natural gas drilling in the Marcellus and Utica Shale regions of Ohio and the potential environmental issues associated with these activities. It also summarizes the regulatory authority of the Ohio Environmental Protection Agency (Ohio EPA) and Ohio Department of Natural Resources (ODNR) over activities associated with natural gas drilling and production.

Where are the Marcellus and Utica Shale Deposits?

Together, the Marcellus and Utica Shale regions extend across New York, Pennsylvania, Maryland, West Virginia, Ohio and portions of Kentucky and Tennessee. The deposits sit between 7,000 and 12,000 feet below ground.

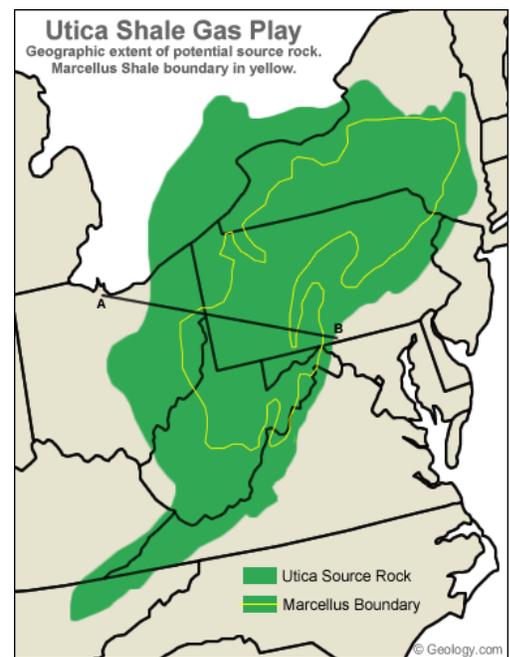
Both are important geologic formations because they hold large reserves of natural gas. Researchers estimate the Marcellus Shale alone could contain as much as 363 trillion cubic feet of natural gas, enough to satisfy U.S. energy demands for about 14 years.

Most drilling is now occurring in the Marcellus Shale region of Pennsylvania, with growing interest in West Virginia and New York. Because the Marcellus Shale is much thinner on its western edge, Ohio is experiencing far less Marcellus Shale drilling than other states. However, Ohio will likely see a significant increase in future drilling, as much of the state sits over the Utica Shale formation, which experts also predict holds large natural gas reserves and potentially oil.

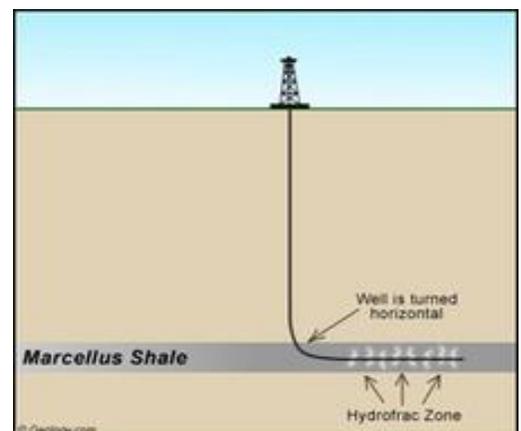
How is natural gas extracted from a shale formation?

Natural gas is extracted from the shale through a two-step process of horizontal drilling and hydraulic fracturing. To start, a production well is drilled thousands of feet downward and then gradually angled out horizontally through the shale deposit. The well is drilled horizontally to maximize the ability to capture natural gas once the shale is hydraulically fractured.

After the well is drilled, a mixture of water, sand and chemical additives is injected at very high pressure to fracture the shale. This part of the process, called hydraulic fracturing (or fracing), is a technique used in the oil and gas industry since the 1950s. The sand keeps the fractured shale open and serves as a conduit for extracting the natural gas.



Marcellus and Utica Shale distribution.



Horizontal drilling process.
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An on-site lagoon is one option for temporary storage of drill cuttings/fluids and flowback water.



As an alternative to a lagoon, some drill sites use a series of frac tanks to collect flowback water.



Frac tanks are hauled by trailer to a disposal location. Photo reprinted with permission of www.marcellus-shale.us.

The chemical additives reduce potential problems during drilling and gas production, such as bacterial build-up and the formation of scale, mineral deposits and rust. It can take up to four million gallons of fresh water to fracture a single well. The water used in the fracturing process usually comes from a stream, river, reservoir or lake near the drill site, or in some cases, from a local municipal water plant.

What happens to water after hydraulic fracturing is complete?

Most of the water used to fracture the shale remains trapped thousands of feet underground after it is injected. However, internal pressure in the geologic formation forces some of the water (around 15-20 percent of the total volume injected) back to the surface through the well bore.

Most of this flowback or frac water comes back to the surface within seven to ten days after it is injected. Flowback water is stored temporarily in lagoons or tanks before being sent off-site for disposal. It is usually transported off-site by truck, although some companies are exploring rail transportation as an option.

Drilling companies send brine and flowback water to disposal facilities that have permits to inject fluids thousands of feet underground into deep injection wells (called Class II wells).

Because of disposal costs, some drilling companies are recycling and reusing flowback water from one drill site to another. Having multiple drill sites in close proximity makes it more cost-effective to reuse flowback water. The concentration of iron, bacteria, suspended solids and other contaminants in flowback water is another factor in determining whether and how often it can be reused.

How is drilling in the Marcellus and Utica Shales regulated in Ohio?

ODNR, Division of Oil and Gas Resources Management (DOGRM), has primary regulatory authority over oil and gas drilling activity in Ohio, including regulations for well construction, siting, design and operation. ODNR regulates disposal of brine¹ and drilling fluids from oil and gas drilling/production. ODNR regulates Class II underground injection wells used for disposal of waste fluids from oil and gas drilling/production operations and transporters hauling these fluids in Ohio.

¹ "Brine" includes all saline geological formation water resulting from, obtained from, or produced in connection with the exploration, drilling, or production of oil or gas, including saline water resulting from, obtained from, or produced in connection with well stimulation or plugging of a well. (R.C. 1509.01(U))

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Ohio EPA's water quality certification requirements help reduce impacts to wetlands, streams, rivers or other waters of the state from the construction of a drill site. Ohio EPA also regulates sources of air emissions, and may require air permits for some of the equipment at the drill site. Finally, any solid waste sent off-site for disposal must be properly managed, either at a solid waste landfill, or beneficially reused, as authorized by Ohio EPA's Division of Materials and Waste and Management (DMWM). A summary of the regulatory authority between ODNR and Ohio EPA is provided in the table on the following page.

What are the environmental concerns with drilling and hydraulic fracturing?

Citizens are becoming more aware and concerned about potential impacts of drilling activity on them, the environment and their communities. Because Ohio has a significant number of permitted Class II underground injection control wells, many drilling companies have been transporting brine and flowback water into Ohio for deep-well disposal.

Flowback water picks up minerals from the shale formation, including iron, calcium, magnesium, barium and sulfur. It may contain low levels of naturally occurring radioactive elements such as radium. It also contains high concentrations of total dissolved solids (TDS), including chlorides, sodium and sulfates. High levels of TDS in streams, rivers or lakes can impair water quality and kill aquatic life.

ODNR has the exclusive authority for brine disposal in Ohio. Ohio prohibits the direct discharge of brine or flowback water into waters of the state. Ohio is not authorizing the disposal of brine or flowback water at municipal wastewater sewage plants (also called publicly owned treatment works or POTWs).

Brine and flowback water disposed of in Ohio must be sent to an ODNR-permitted Class II injection well, unless granted an exemption by ODNR. Where feasible, recycling flowback water is strongly encouraged.

Under ODNR's laws, brine may be suitable for road surface application, if certain conditions are met. Other fluids from well drilling, including flowback water, cannot be applied to roadways. For more information on brine management options, contact ODNR, DOGRM.

Who regulates issues such as truck traffic and road maintenance at a drill site?

There is usually a short-term, but significant level of activity at a drill site, including transporting equipment, production water, sand, flowback water and possibly drill cuttings to and/or from the site. These activities can create significant truck traffic. The volume of truck traffic in a community is not covered under Ohio EPA's or ODNR's regulations. Check with your community officials on local regulations or agreements that may have been established with a drilling company to restrict road access and to fix any damages to roads, bridges or other infrastructure.

Total Dissolved Solids (TDS)

A general term for organic and inorganic particles suspended in a liquid which easily pass through a small membrane filter system.

Total dissolved solids in flowback water include minerals, metals and soluble salts such as sodium, chlorides and sulfates.

TDS in the form of soluble salts in brine and flowback water from shale drilling can reach concentrations as high as 200,000 mg/l. As a point of comparison, the salinity of seawater from concentrated salts is about 35,000 mg/l.

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Summary of ODNR and Ohio EPA regulatory authority over oil/gas drilling and production activities

	Ohio Department of Natural Resources	Ohio Environmental Protection Agency
Drilling in the shale deposits	<ul style="list-style-type: none"> ✓ Issues permits for drilling oil/gas wells in Ohio. ✓ Sets requirements for proper location, design and construction requirements for wells. ✓ Inspects and oversees drilling activity. ✓ Requires controls and procedures to prevent discharges and releases. ✓ Requires that wells no longer used for production are properly plugged. ✓ Requires registration for facility owners with the capacity to withdraw water at a quantity greater than 100,000 gallons per day. 	<ul style="list-style-type: none"> ✓ Requires drillers obtain authorization for construction activity where there is an impact to a wetland, stream, river or other water of the state. ✓ Requires drillers obtain an air permit to install and operate (PTIO) for units or activities that have emissions of air pollutants.
Wastewater and drill cutting management at drill sites	<ul style="list-style-type: none"> ✓ Sets design requirements for on-site pits/lagoons used to store drill cuttings and brine/flowback water. ✓ Requires proper closure of on-site pits/lagoons after drilling is completed. ✓ Sets standards for managing drill cuttings and sediments left on-site. 	<ul style="list-style-type: none"> ✓ Requires proper management of solid wastes shipped off-site for disposal.
Brine/flowback water disposal	<ul style="list-style-type: none"> ✓ Regulates the disposal of brine and oversees operation of Class II wells used to inject oil/gas-related waste fluids. ✓ Reviews specifications and issues permits for Class II wells. ✓ Sets design/construction requirements for Class II underground injection wells. ✓ Responds to questions/concerns from citizens regard safety of drinking water from private wells from oil/natural gas drilling. 	
Brine/flowback water hauling	<ul style="list-style-type: none"> ✓ Registers transporters hauling brine and oil/gas drilling-related wastewater in Ohio. 	
Pumping water to the drill site from a public water supply system		<ul style="list-style-type: none"> ✓ Requires proper containment devices at the point of connection to protect the public water system.

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Will drilling for natural gas contaminate my drinking water well?

The Ohio EPA, ODNR, and other technical experts familiar with hydraulic fracturing do not have data showing a risk of groundwater contamination from brine migrating thousands of feet from the Marcellus or Utica Shale fractures up into drinking water aquifers much closer (hundreds of feet) to the earth's surface.

There is the potential, although unlikely, for contamination of drinking water wells because of problems occurring closer to the surface. Gas and oil can migrate from a production well into an aquifer if a well casing is damaged, leaking or poorly constructed. Natural gas can also enter aquifers from old, abandoned oil and gas wells that are unplugged or poorly plugged. A new water well that is drilled can penetrate gas-rich organic shales or coal seams at shallow depths, allowing gas to enter the well. Buried organic deposits from old swamps or landfills may also release natural gas into soils overlying aquifers.



A Marcellus Shale drill site in Pennsylvania. Photo reprinted with permission of www.marcellus-shale.us.

It's important to know that there have been thousands of oil and gas production wells drilled throughout the state's long history of oil and gas drilling without significant adverse impact to drinking water resources. If you do, however, suspect any problems with your drinking water well as a result of any oil/gas drilling activities in your area, contact the Ohio Department of Natural Resources, Division of Mineral Resources Management at (614) 265-6633.

The Ohio EPA, ODNR and Ohio Department of Health (ODH) have also developed a fact sheet that provides a basic overview for private and/or public well owners who are considering collecting samples prior to oil and gas drilling (including the Marcellus and Utica shale deposits) in areas near their properties. This fact sheet is available at epa.ohio.gov/portals/0/general_pdfs/waterwellsampling.pdf

What about leasing rights if someone wants to drill on my property?

The process of drilling a well begins with a lease agreement between the producing company and one or more landowners that make up a drilling unit. It is important for a landowner approached for a mineral rights lease to be aware of all the conditions of the lease that allow the producer to drill on their land.

Ohio EPA's and ODNR's regulations DO NOT cover private property lease agreements, and we cannot provide homeowners with any specific guidance on this topic. As a starting point for general information for landowners on leases, see ODNR's website at oilandgas.ohiodnr.gov/citizens/leasing-information.

Where can I get more information?

Ohio Department of Natural Resources, Division of Oil and Gas Resources Management, Shale Development webpage: oilandgas.ohiodnr.gov/shale/.

Ohio Environmental Protection Agency, Marcellus/Utica Shale webpage: epa.ohio.gov/MarcellusandUticaShale.