Environmental
Protection Agency

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

July 2011 (Revised)

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.

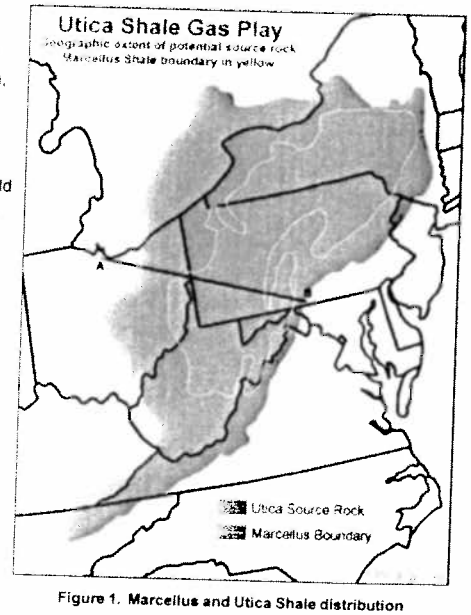


Figure 1. Marcellus and Utica Shale distribution

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. 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.

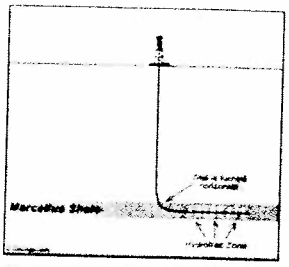


Figure 2. Horizontal drilling process. Graphic reprinted with permission of www.Geology.com

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.

Figure 3. An on-site lagoon is one option for temporary storage of drill cuttings/fluids and flowback water.

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 Mineral Resources Management (DMRM), 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 brine[1] 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.

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 Table 1.

Figure 4. As an alternative to a lagoon, some drill sites use a series of frac tanks to collect flowback water.

Figure 5. Frac tanks are hauled by trailer to a disposal location. Photo reprinted with permission of www.marcellus-shale.us

[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))

Table 1. 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	✓ Issues permits for drilling oil/gas wells in Ohio. ✓ Sets requirements for proper location, design and construction of 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.	✓ 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	✓ 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.	✓ Requires proper management of solid wastes shipped off-site for disposal.
Brine/flowback water disposal	✓ 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	✓ Registers transporters hauling brine and oil/gas drilling-related wastewater in Ohio.	
Pumping water to the drill site from a public water supply system		✓ Requires proper containment devices at the point of connection to protect the public water system.

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.

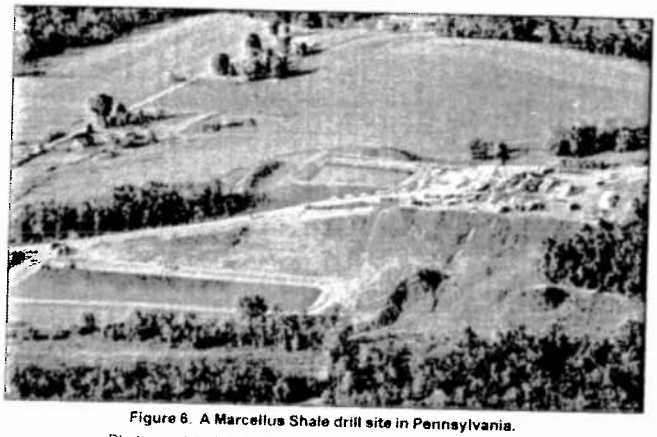


Figure 6. A Marcellus Shale drill site in Pennsylvania.
Photo reprinted with permission of www.marcellus-shale.us.

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, DMRM.

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.

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 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.

Will drilling for natural gas contaminate my drinking water well?

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.

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.

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 **www.epa.state.oh.us/portals/0/general%20pdfs/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 **www.ohiodnr.com/oil/oil_landowner/tabid/17732/Default.aspx**.

Where can I get more information?

Ohio Department of Natural Resources, Division of Mineral Resources Management, Shale Development website: **www.ohiodnr.com/tabid/23415/default.aspx**.

ODNR-Mineral Resources Management
2045 Morse Rd., Building H-3
Columbus, OH 43229-6693
(614) 265-6633

Ohio Environmental Protection Agency, Marcellus/Utica Shale website: **www.epa.state.oh.us/shale.aspx**.

McCracken, Chuck

From: Chuck McCracken
Sent: Monday, August 08, 2011 12:33 PM
To: Stevenson, Laurie
Cc: David Lipp; Mark Light; Michael Snee
Subject: FW: Public comment - new Ohio Administrative Code Chapter 3701:1-43 "TENORM" rules (Technologically Enhanced Naturally Occurring Radioactive Material)

Dear Laurie Stevenson:

Below is the announcement that has been sent to subscribers to "Bradiation", the ODH Bureau of Radiation Protection's list serve.
Please distribute it as you see fit to those participating in the ODNR/OEPA/ODH interagency oil & gas committee.

Thanks,

Chuck McCracken, Supervisor
Bureau of Radiation Protection
Ohio Department of Health
246 N. High Street - 7th Floor 35 Bldg.
Columbus, OH 43215
(ph) 614.466.5136
(fx) 614.466.0381

On behalf of the ODH Bureau of Radiation Protection

From: BRadiation
Sent: Monday, August 08, 2011 11:30 AM
Subject: Public comment - new Ohio Administrative Code Chapter 3701:1-43 "TENORM" rules (Technologically Enhanced Naturally Occurring Radioactive Material)

This announcement is to request your review and comments on rules in Chapter 3701:1-43 of the Ohio Administrative Code, "TENORM" (Technologically Enhanced Naturally Occurring Radioactive Material). The rule has been posted at http://www.odh.ohio.gov/rules/drafts/d3701_1-43.aspx These rules discuss Radiation Safety Standards and Licensing requirements for technologically enhanced naturally occurring radioactive material. These are new rules which utilize CRCPD suggested state regulations in drafting these rules.

Please review the rules and provide any comments that you may have to the Bureau of Radiation Protection of the Ohio Department of Health by **September 17, 2011**. Comments that are received will be forwarded to the Radioactive Materials Committee of the Radiation Advisory Council (RAC). The Committee will consider all comments relative to further changes to the proposed rules. Following this action, the rules will then move through the formal adoption process via the Public Health Council. You may send your comments via regular U.S. mail, or email to the following addresses:

Ohio Department of Health
Bureau of Radiation Protection
246 N. High Street
Columbus, Ohio, 43215 or Bradiation@odh.ohio.gov

McCracken, Chuck

From: Michael Snee
Sent: Thursday, August 04, 2011 1:05 PM
To: Stephen Helmer; Mark Light; Chuck McCracken; David Lipp
Subject: FW: Fracking Radiation Targeted By DOE, GE - Jeff McMahon - The Ingenuity of the Commons - Forbes

FYI

From: crborello@aol.com [mailto:crborello@aol.com]
Sent: Thursday, August 04, 2011 12:34 PM
To: tom.tomastik@dnr.state.oh.us; Michael Snee; thomas.tugend@dnr.state.oh.us
Cc: vpesec@roadrunner.com; k_marx1@yahoo.com; tjlodge50@yahoo.com; millstb@aol.com; nwoej@yahoo.com; lrg904@yahoo.com; lougiavasis1@hotmail.com; marycirelli@neo.rr.com; joe.martuccio@cantonohio.gov; GColeridge@afsc.org; warnermendenhall@hotmail.com; scribman33@yahoo.com; edjulier@aol.com; jrichards13@neo.rr.com; baier13164@aol.com; larry.antonelli@epa.state.oh.us; rod.beals@epa.state.oh.us; ccwits@sbcglobal.net; demst36@yahoo.com; tammyproctor@hotmail.com; tramols@att.net; jeff.gauger@cantonrep.com; kevin.kampman@cantonrep.com; edd.pritchard@cantonrep.com; bdowning@thebeaconjournal.com; slhoffman@thebeaconjournal.com; hnilges@morrowmeyer.com; jdavies3@sbcglobal.net; wi2oh@yahoo.com; apaone@neo.rr.com; nicholsga@att.net; cball105@gmail.com; tommysgirl1863@yahoo.com; damsel16@aol.com; linc20@yahoo.com; fredrossetti@sbcglobal.net; lfuquen@kent.edu; thiggins@kent.edu; mbaughm2@kent.edu; m.baughman@att.net; chuckosborne@neo.rr.com; gail@northcantonohio.com; aleno@plaintownship.com; tyler.converse@cantonohio.gov; allen.schulman@cantonohio.gov
Subject: Fwd: Fracking Radiation Targeted By DOE, GE - Jeff McMahon - The Ingenuity of the Commons - Forbes

Ohio Dept. of Natural Resources
Mr. Thomas Tugend
Mr. Tom Tomastik **cc: ODH Rad Dept. Director, Michael Snee, Ohio EPA, Lawrence Antonelli, Rod Beals**

Re: ***Article indicating that COMFIRMED radioactivity in Gas Well Waste Water needs remediation.*** **So, what *is* currently being disposed of in Ohio's injection wells from other States in massive amounts and can it leak from those injection wells into Ohio's drinking water sources? Is Ohio becoming the *"sacrifice zone"* for big oil and gas industries in the process?**

Gentlemen:

We just obtained today the below article from New York, strongly indicating the confirmed presence of radioactive material in gas well waste water; now apparently *a health risk significant enough* for DOE to fund remediation dollars to remove it,. However, only thanks to the persistent efforts of concerned citizens in PA, who fought over two years trying to call attention to this matter, officials in that State could no longer bury their heads in the sand about what they were allowing to be disposed of into their surface waters at 15 waste water plants that could find its way to citizens' drinking water.

However, here in Ohio, when citizens have dared to raise these same concerns about the presence of long lasting radiation in the gas drilling waste water - currently being hauled into Ohio and injected in MASSIVE amounts beneath our state's aquifers, (as well as still being discharged into surface water at the Warren, Ohio waste water plant for another year) , **our citizens' credible concerns have been outrageously dismissed/trivialized by a top ODNR official and other State officials in positions of authority.**

Instead of providing objective,peer-re viewable responses based upon "best science", citizens are being put off with caustic, subjective replies - or completely ignored with letters sent going unanswered. Just last week, when the radiation concern was again raised by an activist from the Toledo area, it was suggested by an ODNR official that the radiation *just wasn't present in what is being injected,* and therefore a non issue. Incredibly, this state official also in writing went on to suggest that IF we citizens were SO concerned about radiation exposures, we should be getting State officials to address shallow drinking water wells that are drilled likewise, into questionable radiation-bearing shale

formations - a comment that seemed to attempt to distract/redirect attention away from fracking flowback question at hand the citizen was trying to find out about.

Governor Kasich this past week gave a glowing report about all the wealth horizontal drilling will supposedly bring to Ohio, but was quick to toss in something about needing environmental stewardship, as well....**Well, stewardship starts with valid, scientifically supportable science/data as the basis for decisions being made, in order to ensure that the environment, health and welfare of citizens is in fact, being protected. Transparency is essential...To date, clearly the opposite has been the** case...Please review the article below.

Sincerely,

Chris Borello, for

Concerned Citizens of Stark County,
----Original Message-----
From: PHILIP SWEET <gardona12.1@verizon.net>
To: crborello <crborello@aol.com>; micahsmission <micahsmission@aol.com>
Sent: Thu, Aug 4, 2011 7:08 am
Subject: Fracking Radiation Targeted By DOE, GE - Jeff McMahon - The Ingenuity of the Commons - Forbes

http://blogs.forbes.com/jeffmcmahon/2011/08/03/fracking-radiation-targeted-by-doe-ge/

McCracken, Chuck

From: Stevenson, Laurie <laurie.stevenson@epa.state.oh.us>
Sent: Thursday, July 07, 2011 5:00 PM
To: 'Chris.Perry@dnr.state.oh.us'; 'Heidi Hetzel-Evans'; 'mike.hallfrisch@dnr.state.oh.us'; 'mike.mccormac@dnr.state.oh.us'; 'rick.simmers@dnr.state.oh.us'; 'ted.lozier@dnr.state.oh.us'; 'thomas.tugend@dnr.state.oh.us'; 'tom.tomastik@dnr.state.oh.us'; Shear, Aaron; Cirker, Benjamin; Hall, Brian; Lowe, Chuck; Nygaard, Eric; Goicochea, Joe; Weiss, Kristopher; Burkleca, Lee; Taliaferro, Lindsay; Baker, Mike; Eggert, Michael; Parsons, Misty; Settles, Mike; Laake, Ryan; Freeman, Tracy; Harcarik, Tom; Nickel, Brian; Kniss, Donna; Underwood, Dan; Adams, Eric; Gomes, Erm; Snell, Fred; Riley, Keith; Rice, Nancy; Blasick, Rich; DiFranco, Stivo; Saines, Steve; Williams, Steve; Wilson, Virginia; Chuck McCracken; Michael Snee; Rebecca Fugitt; Stephen Helmer; David Lipp; Hopkins, Mike
Subject: FINAL Agenda for Inter-Agency Shale Team meeting on 7/12
Attachments: Marcellus Shale7-12-11Agenda.DOC

Hi everyone. Here's the final agenda for our meeting next Tuesday the 12th from 1:30-4:00 here at Ohio EPA.

For the OEPA district offices, we are testing video conferencing equipment tomorrow and I will let you know if this will be an option for Tuesday. If it isn't, I will get a bridge line so that everyone can at least call in. I'll provide the bridge line number tomorrow.

Thanks.
Laurie

Marcellus Shale Meeting

OEPA/ODNR/ODH
Tuesday, July 12, 2011
1:30 – 4:00 p.m.
Ohio EPA, Center for Excellence
AGENDA

Welcome/Introductions	All
Drilling Activity/Updates	
• Ohio Drilling activity in the Marcellus/Utica – permit and drilling activity update	M. McCormac
New ODNR technical team to look at all the issues surrounding hydraulic fracturing	ODNR
Permit conditions to protect GW and other sensitive environments/update	OEPA/ODNR
401/404	
• Development of General Permit/401 authorization	T. Harcarik
Wastewater/Brine Management	
• POTW wastewater management/update	L. Stevenson/NEDO
• UIC disposal/capacity update	T. Tomastik
Air	
• General Permit for natural gas drilling/production	M. Hopkins
Waste	
• Drill cuttings/solids sampling update OEPA-ODH coordination	J. Goicochea, A. Shear ODH
Outreach/Education/Meetings	
• Media Relations Update	OEPA/ODNR
• Legislative outreach/community meetings	OEPA/ODNR
• OEPA/Sierra Club Meeting	B. Hall/NEDO
• Fact sheets/update	OEPA/ODNR
Next Meeting/Agenda Items	All

McCracken, Chuck

From: Stevenson, Laurie <laurie.stevenson@epa.state.oh.us>
Sent: Thursday, June 09, 2011 4:19 PM
To: 'Chris.Perry@dnr.state.oh.us'; 'Heidi Hetzel-Evans'; Husted, John F.; 'mike.halffrisch@dnr.state.oh.us'; 'mike.mccormac@dnr.state.oh.us'; 'rick.simmers@dnr.state.oh.us'; 'ted.lozier@dnr.state.oh.us'; 'thomas.tugend@dnr.state.oh.us'; 'tom.tomastik@dnr.state.oh.us'; Shear, Aaron; Cirker, Benjamin; Hall, Brian; Lowe, Chuck; Nygaard, Eric; Goicochea, Joe; Weiss, Kristopher; Burkleca, Lee; Taliaferro, Lindsay; Baker, Mike; Eggert, Michael; Hopkins, Mike; Parsons, Misty; Settles, Mike; Laake, Ryan; Freeman, Tracy; Harcarik, Tom; Nickel, Brian; Kniss, Donna; Underwood, Dan; Adams, Eric; Gomes, Erm; Snell, Fred; Riley, Keith; Rice, Nancy; Blasick, Rich; DiFranco, Stivo; Saines, Steve; Williams, Steve; Wilson, Virginia; Chuck McCracken; Michael Snee; Rebecca Fugitt; 'robert.owen@odh.ohio.gov'; Stephen Helmer; David Lipp
Subject: Follow-up items from our inter-agency shale team meeting on 5/4
Attachments: drillersfactsheetV.8.doc; Marcellus Shale-factsheetV.10.doc

Hello everyone. First, I apologize that you have not received the notes from our past meeting. Unfortunately, my laptop has crashed and I'm unsure of whether our IT shop will be able to recover my hard drive files as they work to repair things. I'll get these out to everyone in the event my notes are retrieved.

I think there were a few action items for the team as a follow-up to our meeting, and hopefully everyone can remember what they've committed to getting out to the group. To this end, I'm passing along two DRAFT fact sheets for review by team members. One is a general fact sheet on OEPA requirements
for drillers. I mentioned during our past meeting that we were working on this. The second is a revised version of our general fact sheet that we had previously posted on the website. It's been updated to reflect options for brine/flowback management. For our ODNR team members, although the fact sheet for drillers is intended to focus on OEPA's regs., there are some references to ODNR's requirements, contact info., etc. in it. If we need to discuss/revise any of these items, let me know.

Feel free to mark up the attached electronic copies and send revisions to me. I would like to receive feedback on both items by **June 30th**.

Also, we are scheduled for our next inter-agency team meeting on **Tuesday, July 12th** here at Ohio EPA (Center for Excellence, 6th floor) from 1:30-4:00. I'll get a draft agenda together for review/comment here soon.

Thanks,
Laurie

Ohio EPA's Regulations:

A Fact Sheet for Shale Drillers

DRAFT FACT SHEET

Ohio EPA

June 3, 2011

Introduction

With the state sitting over the Marcellus and Utica shale deposits and advancements in drilling technology, it is expected that Ohio will see a significant increase in oil and natural gas drilling in the near future.

For companies intending to drill in the shale regions of the state, this fact sheet summarizes the regulatory requirements and permits you may need from Ohio EPA. These requirements apply to any drilling operation, but are more likely to apply to activities associated with horizontal drilling and hydraulic fracturing operations.

Understanding these requirements and working early in the process with Ohio EPA and other regulatory agencies overseeing shale drilling can minimize permitting delays for you and help ensure that drilling is done in a manner that protects our citizens and natural resources. Table 1. of this fact sheet provides a summary of the ODNR and Ohio EPA regulatory authority over oil/gas drilling activities.

Ohio EPA's 401 Water Quality Certification (WQC) program requires you get authorization if site construction activities will have an impact on wetlands, streams, rivers or other waters of the state. Ohio EPA also regulates sources of air emissions, and may require air permits for some of the sources at the drill site. Any materials meeting the definition of solid waste sent off-site for disposal from the site must be properly managed.

Drillers also need to obtain permits from the Ohio Department of Natural Resources, Division of Mineral Resources Management (ODNR-DMRM). ODNR, DMRM regulates disposal of brine[1] 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. ODNR-DMRM should be one of your first contacts if you plan to drill in Ohio. For more information, see their Web site at www.dnr.state.oh.us/oil/default/tabid/10371/Default.aspx.

---

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))

Constructing in Areas that Impact Waters of the State

If construction at your drill site will impact wetlands, streams or other waters of the state, you must obtain authorization for these impacts from Ohio EPA under a Section 401 Water Quality Certification (WQC).

Examples of activities that require a 401 WQC include:

- Excavating or placing fill material in a wetland, stream or lake;
- Stream piping, rerouting or straightening;
- Channelization;
- Dredging a wetlands to create a pond;
- Dredging or placing fill into waters of the state;
- Crossing streams or wetlands to construct roadways, water or wastewater piping.

Under the 401 program, you must mitigate wetland impacts by restoring or enhancing wetlands elsewhere. You may also be required to address stream impacts by restoring other stream segments or purchasing conservation easements within the watershed. Your plan for addressing these impacts (called a mitigation plan) is submitted with your 401 application and is reviewed by Ohio EPA.

If impacted streams or wetlands are covered under the jurisdiction of the U.S. Army Corps of Engineers (Corps), you must also obtain a 404 permit from the Corps to authorize impacts to these resources.

Some isolated wetlands are not covered under the federal Clean Water Act, but are regulated under Ohio's isolated wetlands law. If you will impact these areas, you must get an Isolated Wetland Permit from Ohio EPA

Ohio EPA and the Corps regulate impacts to wetlands and other waters, and each has different authority and jurisdictions. This is why you need to work closely with both agencies. Ohio EPA coordinates with the Corps in the 401/404 permit application processes as much as possible. You must obtain the 404 permit and 401 certification before you start construction on the drill site.

IMPORTANT POINTS

You should consider hiring a consultant to inspect the site, as some wetlands may not be easily identifiable by reviewing documents, such as National Wetland Inventory maps.

Start the 401 process early, as on-site review and categorization of wetlands is primarily completed during the growing season.

Due to rule requirements for public notification, acquiring an individual 401 WQC can take 3-6 months.

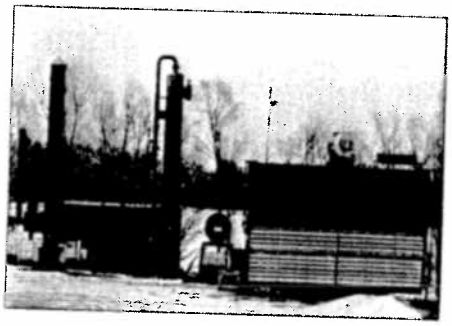
The best option to avoid delays and environmental impact is to look for potential drilling sites where construction will not have any impacts to streams, wetlands or other waters of the state.

For information on Ohio EPA's 401 WQC requirements, visit www.epa.ohio.gov/dsw/401/index.aspx.

For information on U.S. Army Corp 404 permits, visit www.usace.army.mil/CECW/Pages/reg_permit.aspx.

Air Permits for Emission Sources

For units or activities that emit air pollutants, Ohio EPA may require a permit-to-install and operate (PTIO). The terms and conditions of a PTIO usually include emission limits, operating conditions, monitoring and recordkeeping requirements.



A drill site may have several emission sources, including

- Diesel or gas-powered engines/generators
- Gas/water/oil separators
- Produced water storage tanks
- Gas-fired wellhead compressors
- Tri-ethylene glycol (TEG) dehydrators
- Emissions from material handling, truck transportation, etc.
- Tank truck loading operations

A PTIO is required for all emission sources, unless specifically exempt under the Ohio Administrative Code (OAC). Current exemptions include:

1) "De minimis" exemption (OAC rule 3745-15-05): Applies to sources that emit less than 10 pounds per day of any air contaminant and less than one ton (2,000 pounds) per year of any hazardous air pollutant or combination of hazardous air pollutants.

2) Permanent rule exemption (OAC rule 3745-31-03(A)(1)): This rule includes a list of more than 45 sources that are exempt from permitting. Examples include small boilers, detergent-based parts washers, small storage tanks and other sources having minimal air emissions or meeting certain size criteria.

   If you are claiming a permanent rule exemption, you are not required to provide notification to Ohio EPA.

   If you are claiming a de minimis exemption, you are not required to provide notification, but it is recommended that you contact your local Ohio EPA district office or Local Air Agency (LAA) about the source. They can review your de minimis calculations and put information in the file about your exemption to assist future/new inspectors that may be reviewing your site information.

3) Permit-by-rule exemption (OAC rule 3745-31-03(A)(4)): A permit-by-rule (PBR) exemption covers 11 categories of small emission sources. Under the PBR, you are not required to get a permit for the source, but must follow all the requirements in the rules, including meeting emission limits and operational restrictions, and keeping records. You must also file a one-page PBR notification to Ohio EPA.

The first step in getting an air permit is to discuss the equipment you plan to install with the air pollution permit writer located at the Ohio EPA district office or Local Air Agency (LAA) having jurisdiction over the area where your drill site will be located. This discussion is important so that you know what equipment needs an air permit, what applications must be submitted and how long it will take to receive a permit. You can submit your permit application electronically through Ohio EPA's eBusiness Center, or by hard copy directly to your district office/LAA.

For more information on Ohio EPA's air permitting process, exemptions and electronic copies of application forms, visit the Ohio EPA, Division of Air Pollution Control (DAPC) website at www.epa.ohio.gov/dapc/permits/permits.aspx. Ohio EPA's eBusiness Center is at https://ebiz.epa.ohio.gov/.

Managing Brine/Flowback Water from Drilling Operations

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

Total Dissolved Solids (TDS)

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

TDS in the form of soluble salts in brine/flowback water from shale drilling can reach

Lagoons or pits used on-site for temporary storage of flowback water as it is being either recycled or collected prior to off-site shipment and disposal are regulated by ODNR, DMRM. Ohio does not authorize long-term storage of flowback water in on-site lagoons and recommends the use of tanks as an alternative, particularly at drilling sites in close proximity to drinking water resource or where ground water is susceptible to contamination.

EXPLORE OPTIONS TO RECYCLE FLOWBACK WATER

In some situations, flowback water can be recycled and reused at the drill site. Having multiple drill sites in close proximity makes it more cost-effective to reuse flowback water.

ODNR, DMRM has the exclusive authority for brine disposal in Ohio. Ohio prohibits the direct discharge of brine/flowback water into waters of the state. In addition, disposal of brine at municipal wastewater sewage plants (also called publicly owned treatment works or POTW) in Ohio is NOT authorized.

Brine, including flowback water, disposed of in Ohio must be sent to an ODNR-permitted Class II injection well. Where feasible, recycling and reusing flowback water is strongly encouraged. Some materials may be suitable for road surface application, under authorization from ODNR. For more information on brine management options, contact ODNR, DMRM.

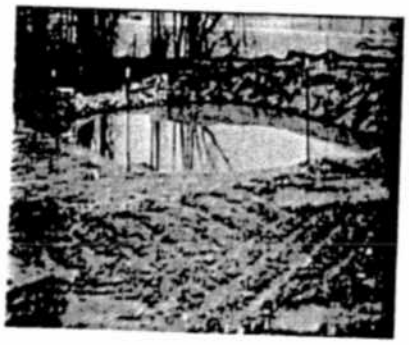
Using Best Management Practices to Control Storm Water Run-off and Erosion

Oil and gas exploration and production sites are not required to obtain a permit from EPA for storm water management under the federal Clean Water Act (CWA). The CWA provisions, do, however, remain enforceable at a site if there is a discharge of any reportable quantities of materials or if a discharge from the site contributes to a violation of a water quality standard. For more information on the federal storm water exemption, see U.S. EPA's website at http://cfpub.epa.gov/npdes/stormwater/oilgas.cfm.

Although a storm water permit from Ohio EPA is not required, ODNR requires drillers to implement best management practices (BMPs) for sediment/erosion control as part of their drilling authorization permit. For more information, see ODNR's Rainwater and Land Development Manual at http://www.dnr.state.oh.us/water/rainwater/default/tabid/9186/Default.aspx

Ohio EPA also encourages oil and gas field operators to use BMPs to minimize discharges of pollutants in storm water, including sediment, both during and after construction, to help protect surface water during storms. Some examples of BMPs include:

- Installing perimeter controls, sediment basins/traps and a stabilized construction entrance as the first step in construction.
- Isolating drainage from the site to eliminate storm water run-on through the site.
- Using a stabilized entrance or wheel wash station to minimizing mud on streets/roads from vehicle drag out.



- Containing and properly disposing of all drilling fluids, including fluids associated with setting the casing and plugging operations.
- Inspecting the site on a regular basis and after a rainfall to determine if additional measures are needed to stabilize the site (e.g., additional stone or temporary cover such as seed and mulch).

Constructing a sediment basin/trap can be more effective and economical than a silt fence in controlling stormwater run-off, because of less maintenance.

Use of Water from a Public Water System and other Water Withdrawals

Between 4 and 6 million gallons of fresh water (called production water) are used to hydraulically fracture a Marcellus or Utica shale gas well. Production water usually comes from nearby lakes, rivers and wells. In some instances, a public water system may serve as the source of production water.

If you intend to pump water from a public water supply system to your drill site, you are required to have proper containment devices at the point of connection to protect the public water system in accordance with Ohio EPA's requirements in OAC 3745-95. At a minimum, this includes a reduced pressure principle backflow assembly at the service connection. An approved air gap separation should be maintained at the drill sight. If an air gap isolation is not maintained at the drill pad, an air gap separation will be required at the service connection.

For more information on Ohio EPA's backflow prevention and cross-connection control regulations, see the Division of Drinking and Ground Waters (DDAGW) factsheet at www.epa.ohio.gov/portals/28/documents/engineering/Cross-connection%20flier.pdf.

Any operation with the capacity to withdraw water at a quantity greater than 100,000 gallons per day from waters of the state must register with ODNR, Division of Soil and Water Resources in accordance with ORC 1521.16. Depending on the location and type of withdrawal other requirements may apply. For more information, see ODNR's website at www.dnr.state.oh.us/tabid/4262/Default.aspx.

Managing Drill Cuttings

Oil and gas exploration and production wastes, including drill cuttings and muds, are exempt from regulation as hazardous waste under Subtitle C of the Resource Conservation and Recovery Act (RCRA). However, federal law does not exempt these wastes from being considered a solid waste under Subtitle D of RCRA and under state law, particularly for cuttings that are shipped off the drill site for disposal.

Cuttings are a mixture of soil, rock, and other matter brought to the surface during drilling of the wellbore. If you are disposing of cuttings at the drill site, this activity is regulated by ODNR. Where drill cuttings come into contact with sources of contamination (e.g. synthetic drilling muds, oils and chemical additives) and cuttings are to be shipped off-site for disposal, Ohio EPA considers these materials contaminated soil, which must be managed as a solid waste. These solid wastes must be sent to a permitted solid waste disposal facility.

Ohio EPA will also consider proposals to beneficially reuse contaminated soils, if constituents within the material are below applicable U.S. EPA residential regional screening levels (RSLs). If you are interested in beneficially reusing contaminated soils, you must get authorization for this activity from Ohio EPA's Division of Materials and Waste Management (DMWM). For more information on the solid waste requirements or beneficial reuse options, contact Ohio EPA, DMWM.

Because certain geologic formations contain low levels of naturally occurring radioactive materials (NORM), some drill cuttings may contain low levels of radioactive materials. The Ohio Department of Health, Bureau of Radiation Protection, is the regulatory authority for the disposal of waste containing sources of radiation. You should contact ODH for more information and guidance on potential sampling requirements for NORM. See the ODH, Bureau of Radiation Protection Web site at www.odh.ohio.gov/odhPrograms/rp/nm_saf/nm_saf1.aspx.

Spill Containment, Control and Release Reporting Requirements

If you handle oil or oil products at your drill site, you could be subject to the Spill Prevention Control and Countermeasure (SPCC) regulations under 40 CFR Part 112. Basic requirements of the SPCC rules include:

1) Provide adequate secondary containment for oil or petroleum product storage and transfer areas to contain any releases; and
2) Prepare and implement a written SPCC plan.

NOTE

Under the SPCC regulations, the definition of oil and oil products is very broad, including: vegetable/soluble oils, heating oil, crude oil, mineral oil, gasoline and diesel fuel.

Whether you are subject to the SPCC requirements depends on your storage capacity for oil/oil products. If you have a total aboveground storage capacity of 1,320 gallons or more, you are subject to the SPCC requirements.

When determining if you are subject to the rules, the total capacity of your tanks or containers must be considered, not the actual amount of oil/oil products stored. If you are storing oil/petroleum products in containers less than 55 gallons in size, you do not need to include these in calculating your SPCC storage capacity.

The SPCC requirements are federal regulations and the program is administered by U.S. EPA. There are no state regulations administered by Ohio EPA for this program. For basic information about the SPCC requirements, see Ohio EPA's fact sheet at www.epa.ohio.gov/portals/41/sb/publications/spcc.pdf. If you have questions about the SPCC regulations, see U.S. EPA's website at www.epa.gov/emergencies/content/spcc/index.htm.

Under Ohio's laws, spills or releases involving a petroleum product (diesel fuel, gasoline, hydraulic fluid, etc.) must be reported, if the spill/release exceeds reportable quantities. The reportable quantities are:

- Any amount of petroleum that causes a film or sheen on a waterway.
- Any spill or release to the environment (not contained on the spiller's property) of 25 gallons or more.

If you are uncertain how much was released, reporting is encouraged. Petroleum product spills of 25 gallons or more on or adjacent to a public roadway are always reportable. Ohio EPA encourages reporting for petroleum spills of any amount if the spill threatens a waterway, or will enter a waterway or storm sewer in the future due to rain or snowmelt if unaddressed. For more information on Ohio EPA's spill/release reporting procedures, see www.epa.state.oh.us/portals/30/ersis/er/docs/Guide%20to%20ER.pdf.

Keys to Successful Permitting

- ✓ **Select your site carefully.** When configuring your drill site, plan to avoid impacts to wetlands and streams. This could eliminate the need for state 401 water quality certification and a permit from the U.S. Army Corps of Engineers.

- ✓ **File complete permit applications.** Include all the information needed on application forms and any additional materials such as design drawings, process information, equipment specifications, etc., required as part of the application. Forgetting even small items can add time to the review process.

- ✓ **Respond promptly to information requests from the district office or local air agency.** The faster you respond, the faster we can continue to process your permits.

- ✓ Some pre-construction activities may be authorized before you actually get your permit, but it's important to **talk with the district office (or local air agency) about what may be allowed before you begin any site activity.**

- ✓ **Once you get your permits, read and make sure you understand them.** If you have questions about any of your compliance requirements under your permits, ask Ohio EPA.

Other Regulatory Requirements You Need to Know

Ohio EPA's regulatory requirements are only one area of compliance. For drilling operations, it is very important you also understand your compliance responsibilities under the Ohio Department of Natural Resources (ODNR) regulations. ODNR's Division of Minerals Resource Management (ODNR-DMRM) has primary regulatory authority over oil and gas drilling activity in Ohio, including permitting requirements and rules for well construction, siting, design and operation. ODNR, DMRM regulates brine disposal and issues permits for Class II underground injection wells used for disposal of waste fluids from oil and gas drilling/production operations. In addition, ODNR regulates transporters hauling these fluids in Ohio.