

Marcellus Shale Meeting

OEPA/ODNR/ODH

Wednesday October 5, 2011

1:30 – 4:00 p.m.

Ohio DNR Fountain Square, Building H
2nd floor conference room

AGENDA

Welcome/Introductions

B. Hall

Drilling Activity/Updates

- Ohio Drilling activity in the Marcellus/Utica – permit and drilling activity update – *OEPA has a checklist - asking for source of freshwater.* M. McCormac

September Energy Summit

GWPL

T. Tugend

Permit conditions to protect GW and other sensitive environments/update

OEPA/ODNR

401/404

- Development of General Permit/401 authorization

*Wetlands Cat 1, II
Dist. 300 ft of stream*

- closes Oct 28

*Pipeline projects - Mainentown - 260 miles - Col., Carroll/Harrison Co
gathering lines, also build 2-3 plants for cracking/energy storage*

Wastewater/Brine Management

- POTW wastewater management/update - *Warren*
- UIC disposal/capacity update

Appeals to

pending permit

B. Hall

12 wells permitted, 3 to be drilled, 8 apps for review

T. Tomastik

Air

Issued 20 permits - FFY 2011

*2nd quarter 2011 - injected 2.8 million barrels
5490 out of district*

- General Permit for natural gas drilling/production

M. Hopkins

Waste/TENORM Update

- Drill cuttings/solids sampling update
OEPA-ODH coordination

ODH, OEPA

Outreach/Education/Meetings

- Media Relations Update
- Statewide regional shale meetings
- Fact sheets/update

OEPA/ODNR

ODNR

OEPA/ODNR

Next Meeting/Agenda Items

OEPA/ODNR

- Set schedule for future meetings/frequency

GWPC -
US EPA preparing to release guidance on VIC regs when using diesel fuel
on trading
- how diesel fuel will be defined
- finalizing study plan for hydr. fract study - ^{by end of year} hope to have plan done by 2014

States

- requiring disch. of frac fluids / rules
- states updating regs -

Env. Defense Fund / SW Energy → working on model framework → Scott Kell helping

- Development of state oil drilling regs & query functions

Mike talked to VPE inquired about
Chesapeake - release of private well sampling - 7500 results

Some concerns that are finding poor water quality - causing decreased property values

Frackfocus.org → well data being entered

Scott Kell - summ. gw contam investigations for OK / Ohio
over 25 yr period - released in August
compared gw incidents compared to changes in regs

→ *check
GWPC
website

Permit Conditions for Oil and Gas Wells

Sensitive Ground Water Settings

Sensitive areas include drinking water source protection areas (aka wellhead protection areas), 100 gpm unconsolidated aquifers and shallow karst or fractured bedrock aquifers. Ohio EPA has provided updated GIS data for drinking water source protection area and public water supply wells to the Division of Geological Survey.

It is a high priority for ODNR/Division of Oil & Gas Resources Management ("Division") to have an inspector on-site to ensure proper well drilling, installation and logging (including appropriate casing, use of centralizers and cementing) when located in a source water protection or sensitive geologic areas.

One-Year Time-of-Travel (TOT) Source Water Protection Areas

It is preferred that oil and gas wells not be drilled within the one-year TOT of a drinking water source protection area delineated for community public water system or a nontransient noncommunity public water system serving a school. ODNR cannot explicitly prohibit the installation of an oil/gas well within the one-year TOT, however, ODNR will work with the owner/operator to evaluate whether an alternative drill site location within the lease area could be selected to minimize the risk to the public water system.

Pits or impoundments containing oil field fluids including drilling, hydraulic fracturing flowback water will not be located within the one-year TOT of a drinking water source protection area for a community public water system using ground water. ODNR will require steel tanks with secondary containment to manage fluids in the delineated one-year TOT source water protection areas.

If drilling does occur within the one-year TOT of a drinking water source water protection area, ODNR will require all public water supply wells associated with that area to be sampled in accordance with guidelines provided in the Division of Mineral Resources Management's BMPs for pre-drilling water sampling.

Highly Susceptible Five-Year Time-of-Travel (TOT) Source Water Protection Areas

It is preferred that pits or impoundments containing oil field fluids including drilling, hydraulic fracturing flowback water not be located within the outer management zone (5 year TOT) of a drinking water source protection area for a community public water system, or nontransient noncommunity public water system serving a school, determined to have a high susceptibility to ground water contamination.

As an alternative ODNR will encourage the use of steel tanks with secondary containment. If a pit is used within highly susceptible five year TOT source water protection area ODNR will require a synthetic liner and closure within 14 days from ceasing drilling activity at the site including removal of all liquids, solidification and removal of remaining solids (i.e. cuttings) and liners.

If drilling occurs within the 5 year TOT of highly susceptible drinking water source water protection area ODNR will require the owner/operator to sample all public water supply wells associated with that area in accordance with guidelines provided in the Division of Mineral Resources Management's BMPs for pre-drilling water sampling.

Sensitive Geologic Settings (unconsolidated aquifer system capable of sustaining a yield of 100 gallons per minute and shallow karst or fractured bedrock)

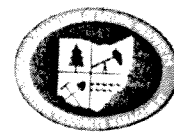
The Division will continue to apply the Thin Till permit conditions for fractured bedrock as has been the practice since the 1980's. These conditions specifically address the criteria for when a pit can be constructed or steel tanks are required. They also contain the requirements for pit construction.

In an unconsolidated aquifer system capable of sustaining a yield of 100 gallons per minute, the Division will monitor the occurrence of drilling activity and will share this information with the OEPA for a period of one year. At the end of this time, both agencies will evaluate the need to amend this document accordingly.

Stormwater BMPs for > 1 Acre Disturbed Land Area

ODNR will recommend the following stormwater controls for any drill pads larger than one acre in size. ODNR oil and gas inspectors will perform a presite review before issuing a Marcellus or Utica/Point Pleasant shale drilling permit.

- Establish positive drainage from all disturbed areas to a sedimentation basin, or equivalent, sized in accordance with standards found at <http://www.dnr.state.oh.us/tabid/9186/default.aspx> or subsequent BMP's developed by the Division. The sedimentation pond shall be separate from any pits/ponds constructed for containing drilling fluids, cuttings or flowback water.
- Isolate the site to prevent stormwater run-on through the site.
- Ensure containment and proper disposal of all drilling fluids associated with all operations including fluids associated with the setting of the casing and plugging operations.
- Minimize vehicle drag out of mud onto public streets through the use of a stabilized entrance to the site or wheel wash station if necessary.



Recommendations for Water Well Sampling Before Oil and Gas Drilling

June 2011

Introduction

This fact sheet 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. If you are collecting water data to document water quality, you should follow a few important steps as outlined in this fact sheet. These include obtaining information on your well, such as when and how it was constructed; conducting research on certified laboratories in your area and sampling costs; and ensuring labs follow proper procedures and sample collection methods.

Who regulates oil and gas well drilling in Ohio?

The Ohio Department of Natural Resources, Division of Mineral Resources Management (ODNR-DMRM) regulates and monitors oil and gas drilling in Ohio. More information is located at: http://www.ohiodnr.com/portals/11/publications/pdf/Marcellus_Shale_Fact_Sheet.pdf.

Will oil and gas well drilling really affect my water well quality or quantity?

Modern oil and gas well drilling is a highly technical and closely monitored process with regulations in place to protect underground sources of drinking water during and after the drilling process. The chance of ground water contamination or loss of water due to oil and gas well drilling is very small. If ground water quality impacts from drilling activities occur, they most often are within a few hundred feet of the drill site.

What information should I obtain prior to collecting a water sample from my well?

Ohio laws require that a water well record known as a well log be filed for all wells drilled since 1945 and some well logs were filed prior to that time. Well log records can be found on ODNR's website at: <http://www.dnr.state.oh.us/water/maptechs/wellogs/appNEW/> or call ODNR at (614) 265-6740 for assistance.

Well logs show how deep a water well is drilled and how it is constructed. Knowing the depth of your well and the type of geologic materials (i.e. sandstone, shale, limestone, sand and gravel) that are producing the ground water is important information in the event of water quality impacts.

What else do I need to know before sampling?

Conduct research on the laboratories in your area and the services they offer. Be an informed consumer and get the most for your money. Water samples must be collected and analyzed using proper sampling and laboratory protocols and methods and careful documentation of sample chain of custody. Some labs will come and collect the sample for you, others will only provide the sample containers. Some local health districts or soil and water conservation offices offer sample collection and coordinate with labs for sample analysis. The State of Ohio highly recommends using a qualified professional to ensure proper collection your water sample. Improper sampling can result in unreliable data and waste your financial resources.

Recommendations for Water Well Sampling Before Oil and Gas Drilling

Are there special water sampling and analysis procedures?

Water sampling should be done only by a professional who is familiar with all sampling and laboratory protocols. Samples should be submitted to an Ohio Environmental Protection Agency (Ohio EPA) certified drinking water laboratory. The laboratory should be certified for each chemical parameter to be tested. Without attention to these details, water analyses will be of little or no value in an oil and gas water contamination investigation or a legal proceeding. A list of Ohio EPA-certified laboratories for drinking water analysis is available on the Agency's website at <http://www.epa.ohio.gov/ddagw/labs.aspx>.



*original
using state agency approved std methods
must be used for the water sample and*

What procedures should occur during water sampling?

The water sample should be collected before any treatment devices (bypassing these devices) such as water softeners or disinfection units as they can affect water quality. This sample location will likely be a spigot or drain at or near the pressure tank before any treatment units. The water sample collected should be representative of water in the well; therefore, it is important to run the water for at least 5-10 minutes to flush out all the water in the well to ensure a sample of fresh ground water is obtained. The water sampling professional will document the sample location, date and time, and will collect the water in containers designed for the specific parameters to be analyzed. Preservatives may also be added to the sample container to stabilize the sample on site before transport to the lab. Parameters such as pH and conductivity may be measured with equipment during sample collection.

What should the water well sample be analyzed for?

The following sample parameter sets are recommended for establishing background water quality and are grouped in order of importance. The more parameters analyzed, the higher the cost of the water analysis. If funds are limited, start with the Tier 1 sample set.

Tier 1 Water Sample Parameters	Tier 2 Water Sample Parameters	Tier 3 Water Sample Parameters
Barium Chloride Magnesium Potassium Sodium Strontium Sulfate Total dissolved solids Specific Conductivity	Tier 1 sample parameters+ Calcium Hardness Total Alkalinity pH Iron Manganese Total suspended solids Bromide	Tier 1 and 2 sample parameters+ BTEX (benzene, toluene, xylene, ethylbenzene) <u>Methane (dissolved)</u> <i>*Methane (d)</i>

Tier 1 water sample parameters are recommended for homeowners who have basic concerns and would like to establish background water quality. If chloride levels are greater than 250 parts per million (mg/l), then Tier 2 sampling is recommended. Background water quality data for chloride and bromide is useful for identifying potential sources of chloride contamination. Ideally, two or three samples should be collected in different seasons to allow you to establish the normal variability in ground water quality over time due to rainfall and other factors.

** Low levels of methane in water wells are common in many areas of the state. If methane is present -*

Recommendations for Water Well Sampling Before Oil and Gas Drilling

What do my sample results mean?

Ground water quality can vary over time and the seasons, and is influenced by the type of geologic materials the ground water is moving through, natural replenishment from rainfall and flooding (recharge), and chemicals used or applied on the ground surface that are transported by recharge moving to the ground water. Subsequently, your water sample is a snapshot in time of the water quality in your well. The Ohio EPA and other state agencies have collected background water quality data across the state as part of an ambient ground water quality monitoring program. Data on natural ground water quality can be found at: http://www.epa.state.oh.us/ddagw/gwqcp_ambient.aspx.

Are there health-based standards that apply to private wells?

The Ohio Department of Health (ODH) has established health-based standards for private water systems that are the same as the standards for public water supply systems established by the Ohio EPA and U.S. EPA. They can be found on the Ohio EPA website at <http://www.epa.state.oh.us/portals/28/documents/DWStandardsList.pdf>.

Information on health risks associated with each water quality standard can be found at the ODH website at: <http://www.odh.ohio.gov/odhPrograms/eh/water/PWShminfo.aspx> and at the U.S. EPA website at: <http://water.epa.gov/drink/contaminants/basicinformation/index.cfm>.

What type of ground water investigations does ODNR – DMRM conduct related to oil and gas drilling?

Since 1983, ODNR – DMRM has conducted ground water investigations in Ohio when complaints alleging ground water contamination by oil and gas drilling are received. ODNR – DMRM technical staff respond within 24 hours and use advanced equipment that allows for a complete groundwater investigation. Since regulations were strengthened in 1985, ground water contamination cases caused by oil and gas operations have dramatically decreased.



Are there regulations to provide for the replacement of my well if it is impacted by oil and gas drilling?

Section 1509.22 (F) of the Ohio Revised Code gives the authority to ODNR – DMRM to require an owner/operator of an oil and gas well to replace the water supply of the holder of interest in real property whose water supply has been substantially disrupted by contamination, diminution, or interruption resulting from the owner's oil and gas operation. This includes supplies of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source.

Where can I get more information on Marcellus and Utica Shale drilling?

- **Ohio Department of Natural Resources**, Division of Mineral Resources Management, Oil and Gas website: www.ohiodnr.com/mineral/oil/tabid/10371/default.aspx.
- **Ohio Environmental Protection Agency**, Shale gas drilling website: www.epa.state.oh.us/dsw/pretreatment/marcellus_shale/index.aspx.

Recommendations for Water Well Sampling Before Oil and Gas Drilling

Who should I contact with more questions?

Ohio Department of Natural Resources
Division of Mineral Resources Management
2045 Morse Rd.
Building H-3
Columbus, OH 43229-6693
(614) 265-6633
Email questions to: minerals@dnr.state.oh.us
<http://www.ohiodnr.com/mineral/oil/tabid/10371/Default.aspx>

Ohio EPA
Division of Drinking and Ground Waters
P.O. Box 1049
Columbus, OH 43216-1049
(614) 644-2752
Email questions to: ddagw@epa.state.oh.us
www.epa.ohio.gov/ddagw/

Ohio Department of Health
Bureau of Environmental Health
246 N. High St.
Columbus, Ohio 43215
Email questions to: BEH@odh.ohio.gov
<http://www.odh.ohio.gov/odhPrograms/eh/water/water1.aspx>

Directory of Local Health District in Ohio:
<http://www.odh.ohio.gov/localHealthDistricts/lhdmain.aspx>

Rebecca Fugitt

From: Eggert, Michael [michael.eggert@epa.state.oh.us]
Sent: Thursday, September 29, 2011 2:59 PM
To: Kenah, Christopher; Rebecca Fugitt; Ralph J Haefner; Tomastik, Tom; Eggert, Michael
Subject: RE: Mtg Time: Water Well Sampling Prior to O&G Drilling Fact Sheet
Attachments: Water_NGWA_Wells_in_proximity_info_brief_2011.FINAL.pdf;
OTSEGOCounty_Well_Water_Monitoring_Guidance.pdf; NYDEP_Schuyler Final Water
Testing Guidance.pdf; PENN_5500-FS-DEP4300.pdf

Thanks to everyone for agreeing to participate in this meeting. Based on everyone's schedule, we plan to meet at 1:00, October 3rd at ODNR H-3.

The two primary questions are as follows:

1. Can we refine the list of recommended parameters for Tier 1 or change to the Penn. approach?
2. Are we willing to recommend non-drinking water certificated lab methods? We recommend testing raw water prior to treatment so many other water test methods (e.g. VAP certifications, NELAC) are probably valid. Does ODNR DMRM laboratory use drinking water methods for analysis?

Attached are some additional guidance documents.

Mike

From: Kenah, Christopher
Sent: Thursday, September 22, 2011 8:30 AM
To: Fugitt, Rebecca J.; Ralph J Haefner; Eggert, Michael
Subject: RE: Meeting Availability - To Discuss Water Well Sampling Prior to O&G Drilling Fact Sheet

I am available at the times Rebecca has listed.
Chris Kenah

From: Rebecca Fugitt [mailto:Rebecca.Fugitt@odh.ohio.gov]
Sent: Wednesday, September 21, 2011 3:05 PM
To: Ralph J Haefner; Eggert, Michael
Cc: Kenah, Christopher
Subject: RE: Meeting Availability - To Discuss Water Well Sampling Prior to O&G Drilling Fact Sheet

Sept 26 am, and Oct 3 and 4 in pm, and Oct 5 in the am are ok for me.

From: Ralph J Haefner [mailto:rhaefner@usgs.gov]
Sent: Wednesday, September 21, 2011 10:37 AM
To: Eggert, Michael
Cc: Kenah, Christopher; Rebecca Fugitt; Rebecca Fugitt
Subject: Re: Meeting Availability - To Discuss Water Well Sampling Prior to O&G Drilling Fact Sheet

Sorry to say, but I am unavailable during both of those time slots. I am available on:

Sep 26, 27, 30 (anytime)
Oct 3, 4 (early afternoon only)

Oct 5, 13 (anytime)

Ralph.

Ralph J. Haefner, Supervisory Hydrologist
U.S. Geological Survey Ohio Water Science Center
6480 Doubletree Avenue
Columbus, OH 43229-1111
Office: 614-430-7709
Mobile: 614-579-4105
<http://oh.water.usgs.gov/>

-----"Eggert, Michael" <michael.eggert@epa.state.oh.us> wrote: -----

To: "Kenah, Christopher" <Christopher.Kenah@epa.state.oh.us>, "Fugitt, Rebecca J." <Rebecca.Fugitt@odh.ohio.gov>, "Fugitt, Rebecca J." <Rebecca.Fugitt@odh.ohio.gov>, Ralph Haefner <rhaefner@usgs.gov>
From: "Eggert, Michael" <michael.eggert@epa.state.oh.us>
Date: 09/20/2011 04:40PM
Subject: Meeting Availability - To Discuss Water Well Sampling Prior to O&G Drilling Fact Sheet

Thanks for agreeing to meet to discuss the some proposed modifications to the Water Well Sampling Prior to O&G Drilling Fact Sheet that has been requested by our Director. I'll explain more at the meeting but essentially the question is - Can we reduce the number or refine the primary (Tier 1) parameters.

What is your availability to meet on either Thursday Sept 29 (anytime) or Monday Oct 3 during the morning?

Mike

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Managing your Private Water Supply Related to Natural Gas Development in Schuyler County

Assessing Risk

One of the most frequent concerns when discussing hydrofracking and natural gas development within Schuyler County is the potential impact to water resources—often directly, “what are the risks to my water supply?” and “what should I do to protect my own water supply?” The answer to the first question is particularly polarizing, often hotly debated, and will certainly not be answered within this document. The answer to the second question is more easily provided—although not without its own costs, caveats and disclaimers. As the owner of a private water supply, you are in charge and responsible to ensure that the water you get from the faucet is suitable to drink—not the town, county, state or the federal government. A considerable amount of legislation and public money has been expended to protect that water from contamination, but in the end, no institution can ensure that the water from your own well is fit to drink.

So, the simple answer to the second question (what should I do to protect my water supply?) is; if you have a private water supply have your water tested for various parameters prior to drilling in your area, continue testing during the development activity to compare and assess potential impact, and then continue testing for several months to years after drilling has ceased. The real difficulty comes in deciding what parameters to test for and when to conduct the testing. It should be noted that under the draft NYS DEC regulations, the drilling company is required to conduct testing, through an independent testing company, for any private supply if you are within 1000 ft (or 2000 ft if no private supplies exist within 1000 ft) of a proposed gas well. This takes place at the company’s expense and at regular intervals thereafter. The required testing parameters are indicated on the table under column 1.

When and how to test

Testing should occur as close as possible to the date the development activity will take place. It appears likely that most hydrofracking activity in NYS will occur east and south of Schuyler, at least during the initial phases. Therefore, while it’s appropriate to routinely test your water for contamination and you are encouraged to do so, if your concern within Schuyler County is hydrofracking, testing your water now is likely not an economical means to protect your water supply (unless you’re interested in establishing a true baseline study; which entails spending thousands of dollars over several seasons). All analysis should be conducted by an independent, third party NYS approved laboratory (list available at www.wadsworth.org). It is also encouraged to have an unbiased third party, such as the Schuyler County Watershed Protection Agency or the lab, collect the sample. Preferably, analysis is suggested to take place one to three months prior to development of the gas well. It is recommended to have additional follow up analysis conducted every three months until the drilling activity ceases, at which point it’s suggested to occur yearly thereafter.

What to test

Generally speaking, the greater the number of parameters analyzed, the better position you’re in to adequately assess your health risks. Unfortunately all tests cost money and the more tests you do the more you spend. With this paradox in mind, the Schuyler County Energy Task Force and the Water Quality Coordinating Committee compiled a broad array of parameters for testing prior to drilling (column 2), and then reduced the number of parameters collected for follow up sampling (column 3 if affordable, column 4 at minimum). The parameters suggested are chosen as broad chemical indicators of the most possible water quality risks, while also reflecting analytical costs. However, if the costs are not prohibitive, more parameters are better (columns 1 or even all parameters listed). In the event testing indicates variation within the results, a broader suite of follow up tests is advisable. As a disclaimer, these parameters are offered as general guidance and do not address all potential health risks associated with your water supply. The recommendations do not represent a technical review of current or proposed hydraulic fracturing practices and associated risks, and should be viewed as advisory.

Additional Resources and Contacts

For the purposes of this guidance document, multiple sources were researched. Two documents, Otsego County Soil and Water Conservation District’s “General Guidance Document on Well Water Monitoring in Advance of High Volume Horizontal Hydrofracking” and Penn State Coop Ext Water Fact Sheet #28 “Gas Well Drilling and Your Private Water Supply”, were particularly useful and are referenced within the table on the opposite page (columns 5 and 6), and should be consulted by anyone considering conducting analysis (both documents are readily available on line). Additional information on water quality testing and water supply concerns can be obtained by contacting the Schuyler County Watershed Protection Agency at 607-535-6868 or the Hornell District Field Office of the NYS Dept of Health at 607-324-8371.

		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	
Approx. Cost (not including collection and other fees)	Compound	NYS DEC Mandated test within radius from Draft Regulation	Suggested Baseline Testing	Reduced Follow Up Testing	Minimum Follow Up Testing	Penn State Ext WQ Fact Sheet #28	Otsego SWCD Guidance Doc	Maximum Contaminant Level or guideline recommendation*
\$15-25	Chloride	X	X	X	X	X	X	250 mg/l
\$10-15	Total Dissolved Solids (TDS)	X	X	X	X	X	X	500 mg/l
\$15-20	Conductivity		X	X	X		X	no designated limit
\$10-20	Chemical Oxygen Demand		X	X	X			no designated limit
\$5-10	pH	X	X	X	X	X	X	no designated limit
\$20-25	Bromide		X	X			X	no designated limit
\$8-15	Total Hardness	X	X	X		X	X	no designated limit
\$40-50	Gross Alpha	X	X	X		X		15 picocuries/liter
Incl. above	Gross Beta	X	X	X				4 mrem/year
\$15-20	Alkalinity	X	X			X	X	no designated limit
\$10-15	Turbidity	X	X					5 NTU
\$15-20	Barium	X	X			X	X	2 mg/l
\$15-20	Iron	X	X				X	0.3 mg/l
\$15-20	Manganese	X	X				X	0.3 mg/l
\$18-25	Arsenic	X	X			X	X	0.01 mg/l
\$18-25	Strontium	X	X					no designated limit
\$125-175	Methane	X	X			X	X	no designated limit
\$40-50	Detergents and surfactants		x			x	x	no designated limit
\$10-20	Coliform bacteria	X				X		Any positive result is unsatisfactory
\$15-20	Lead	X				X	X	0.015 mg/l
\$10-20	Nitrate	X				X		10 mg/l as N
\$10-20	Nitrite	X						1 mg/l as N
\$10-15	Total Suspended Solids (TSS)	X				X	X	no designated limit
\$15-20	Carbonates	X						no designated limit
\$15-20	Bicarbonates	X						no designated limit
\$20-30	Sodium	X				X	X	no designated limit
\$25-40	Iron plus manganese	X				X		0.5 mg/l
\$18-25	Sulfate	X				X	X	250 mg/l
\$25-35	Hydrogen sulfide	X					X	no designated limit
\$70-80	Benzene	X						0.005 mg/l
varies	Static water level	X					X	n/a
\$25-35	Total Organic Carbon					X	X	No designated limit
\$135-150	Volatile Organic Compounds (incl BTEX)					X	X	Varies
\$28-35	Oil and Grease					X		Varies
\$60-70	Radon in Water					X		no designated limit
\$150-175	Radium 226 and 228					X	X	5 pCi/L
\$45-55	Total petroleum hydrocarbon						X	no designated limit
\$15-20	Potassium						X	no designated limit
\$1050 - 1450	Approximate Total Cost	\$575 - 700	\$400 - \$450	\$125 - \$150	\$60 - \$75	\$800 - 900	\$775 - 850	*MCL and guidelines taken from US EPA / NYS DOH material

Note—these parameters are offered as general guidance and do not address all potential health risks associated with your water supply. The recommendations do not represent a technical review of current or proposed hydraulic fracturing practices and associated risks, and should be viewed as advisory.



Otsego County Soil & Water Conservation District
967 CO HWY 33 – RIVER ROAD – COOPERSTOWN, NEW YORK 13326-9222 – PHONE (607) 547-8337 ext. 4

General Guidance Document on Well Water Monitoring In Advance of High Volume
Horizontal Hydrofracturing

Background: With the potential for wide-spread, high-volume, horizontal hydrofracturing natural gas development to take place within Otsego County, many residents and local municipal officials have expressed concern over the possibility of well water contamination that may come as a result. While the New York State Department of Environmental Conservation (DEC) does recommend, and may require, gas companies to test wells within a particular distance of a drilling operation, individuals or local governments outside this area may still wish to establish a 'pre-drilling baseline' on the water quality of their own private or municipal well.

One factor keeping such individuals and municipalities from beginning this process has been the lack of any 'official' guidance from DEC or Department of Health (DOH). Although the draft Supplemental Generic Environmental Impact Statement (dSGEIS) currently being reviewed by DEC does suggest a list of parameters (Chapter 7, pages 40 & 41), any official recommendations that come from that process will most likely be included final SGEIS. At that point in time, permits for drilling could be issued and the opportunity to collect a pre-drilling baseline data set would have passed for some.

In the interim, and until official guidance is provided by the State, a local working group consisting of the Otsego County Soil and Water Conservation District, Otsego County Planning Department, SUNY Oneonta faculty and Hartwick College faculty, are providing this *unofficial general guidance* for those who would like to acquire water quality data on their wells now.

This general guidance was developed by comparing lists of parameters previously made available by industry, environmental consulting firms, DEC (as identified above), Penn State Cooperative Extension (Water Fact Sheet #28) and other Counties in NY. This comparison was assisted by H2H Associates, a private environmental consulting firm, and concluded with a list of 24 parameters seen as most appropriate and cost effective in detecting potential contamination. To address the issues of frequency and duration, the working group also consulted with a representative of the United States Geological Service (USGS).

Thanks go out to all these individuals, agencies, departments and all of those who have commented and advised during the formulation of this general guidance. Additional thanks go to all of those participating in the public discussion for making so much good information readily available.

What to Test for and Why: Below is the list of parameters recommended for testing along with a brief explanation as to why they are relevant and, where appropriate, US EPA drinking water guidelines.

1. **Alkalinity** – Alkalinity is often the dominant anion in groundwaters. Monitoring changes in alkalinity can indicate other changes in water chemistry.
2. **Arsenic** – Arsenic may be found in biocides used in hydrofracking fluids. It may also be liberated from shales when reacting with drilling fluids. US EPA (1986) drinking water guideline is 0.05 mg/L.
3. **Barium** – A principle component of drilling muds. US EPA (1986) specifies a drinking water guideline of 1.0 mg/L.
4. **BTEX** –Benzene, Toluene, Ethylbenzene, and Xylene. The US EPA drinking water standards for each of these parameters are: 0.005, 1.0, 0.7, and 10.0 mg/l respectively. These are sometimes added to fracking fluids to provide lubrication for the injection of propants used to keep fractures open.
5. **Bromide** – Bromide salts may be added to water as a mild biocide.
6. **Chloride** – A possible component of shale brines. US EPA (1986) drinking water guideline is 250 mg/L.
7. **Conductivity** – Electrical conductivity is one of the simplest and least expensive water quality indicators. As the amount of dissolved substances in water increase, so too does the ability of water to conduct an electrical current. Electrical conductivity is then a useful proxy for the amount of substances dissolved in water.
8. **Dissolved Methane & Ethane** – Occurs naturally in local aquifers but may also leak into aquifers as a product of drilling and production.
9. **Hydrogen Sulfide** – H₂S is a naturally occurring gas that forms under similar environmental conditions that generate methane. H₂S concentrations in deep shales are likely to be higher than surface concentrations. H₂S is also a by-product of certain bacteria.
10. **Iron** – Commonly found in local waters, iron may also be present in shale beds and may be liberated from shales during gas development. New York State maximum contaminant level of 0.3 mg/l.
11. **Lead** – Lead is a known neurotoxin. The US EPA (1986) specifies a drinking water standard of 0.05 mg/L. Rock cuttings from the Marcellus shale may release small amounts of lead and other metals when washed with rain water.
12. **Manganese** – Commonly found in deep groundwater aquifers, manganese produces a black stain in the presence of oxygen. The US EPA (1986) specifies a drinking water guideline of 0.05 mg/L.
13. **MBAS (Surfactants/Detergents)** – Detergents are used in the hydrofracturing process to aid the liberation of gas from rock. Measuring MBAS levels in water can help indicate the presence or absence of hydrofracturing fluids in water supplies.
14. **pH** – A basic water parameter sensitive to small changes in water chemistry. Acids used in hydrofracking fluids may lower the pH of water. US EPA (1986) drinking water guideline is 6.5-8.5.

15. **Potassium** – Like sodium, potassium is commonly found in deep shale brines and gas well flowback.
16. **Radium 226/228** – Black shale beds commonly have elevated concentrations of uranium. The radioactive decay of uranium results in the production of radium gas, which in turn decays into radon gas (a well known cause of lung cancer). There is concern that natural gas development may increase the migration of radium from deep shale beds to shallow aquifers. US EPA (1986) drinking water guideline is 5 pCi/L combined.
17. **Sodium** – Sodium is commonly found in deep shale brines and gas well flowback.
18. **Strontium** – Strontium has been commonly found in waters associated with shale beds. Strontium levels may help fingerprint water migrating from natural gas formations.
19. **Sulfate** – Sulfate is produced by both the oxidation of iron sulfide minerals commonly found in black shales, as well as the dissolution of gypsum found in deep rock units in New York. Shale brines can be expected to have elevated concentrations of sulfate. The U.S. EPA has a drinking water quality guideline of 250 mg/L.
20. **Total Dissolved Solids** – Deep shale brines may have a high TDS. Also indicates all dissolved species in water. US EPA (1986) drinking water guideline is 500 mg/L.
21. **Total Hardness** – Hardness is a measure of all the calcium and magnesium dissolved in a water sample and are common in areas with limestone. Both calcium and magnesium levels may be affected by changes in water chemistry due to mixing with natural gas fluids.
22. **Total Organic Carbon** – TOC can indicate the presence or absence of dissolved organic compounds in water. In the case of natural gas flowback waters, changes in TOC could indicate changes in methane, BTEX, detergents, and biocides.
23. **Total Petroleum Hydrocarbon** – Hydrocarbons may be injected into shales as a lubricant in hydrofracturing fluids. Hydrocarbons may also occur naturally in shale beds.
24. **Total Suspended Solids** – This is a direct measurement of all particulate matter transported by water which can cause water to look cloudy or turbid. Changes in suspended sediment in groundwater can be caused by the growth of organic material, the precipitation of iron minerals, or the mobilization of fine grained sediments caused by injecting water or pumping water from an aquifer.

In addition to the list of parameters provided above, we also recommend that *static water level* be measured by the commercial lab (see below) at the time of sampling. This requires opening the well cap and measuring depth to water with a probe when the pump is not running. The static water level reflects the level of the water table and can influence the water quality of the well. Therefore knowing what your static water level is important to the interpretation of the results and should be measured when the sample is taken. The best time to measure static water level is mid-day after morning water use is done and the well has had time to recover.

The Environmental Laboratory Approval Program (ELAP): Who performs the work of collecting and then analyzing well water samples is of critical importance. One purpose of the data collected may be to demonstrate well contamination. This makes properly collected, documented, accurate and reliable environmental analyses critical. The Wadsworth Center was established in 1984 under Section 502 of the Public Health Law and is responsible for the certification of laboratories performing environmental analyses on samples originating from New York State.

In all cases, it is highly recommend that landowners and municipalities only use laboratories certified in ELAP when testing for the parameters recommended here. To view a list of New York State ELAP labs and laboratories in other states certified under the national program, go to: <http://www.wadsworth.org/labcert/elap/comm.html>.

It is further recommended that the commercial laboratory selected be provided any well specific information available (age, depth, location, water source, etc) to assist in interpretation the results and so that modifications to this general guidance can be made if necessary.

Sampling Strategies: The two sampling strategies offered here focus on detecting a significant change in the concentration of any of the recommended parameters over a time period that spans pre- and post-drilling. This is done by first establishing the normal variation in concentration of a parameter prior to drilling (due to change in season and annual precipitation) and then looking for a much different measurement (out of the normal variation) during and after drilling.

The key to establishing variation is to measure the parameter repeatedly at different times of year and for multiple years. However, sampling for the number of parameters recommended here is not inexpensive and cost must also be considered when deciding how frequently and for how long to sample. For this reason two sampling strategies are offered here.

First is a 'base-line' sampling strategy that relies on regular sampling with additional comparisons of indicator parameters during and after drilling activities. This approach may be most suitable for municipalities or clusters of similarly situated wells. The second strategy is a less costly and less intensive protocol that does not establish a baseline but rather provides a one-time 'snapshot' of pre-drilling water quality with subsequent comparisons of indicator parameters until such time that another 'snapshot' may be warranted.

Results should be compared against the limits described in the 'What to Test for and Why' section of this document and previous measurements. In all cases, consultation with the selected commercial laboratory regarding the interpretation of results is recommended.

