Methane (Natural Gas) In Ohio Private Water Wells

Ohio Department of Health
Bureau of Environmental Health
2013 Midwest Workshop
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What is methane and what is the difference between natural gas and methane?

- Methane is the simplest alkane and has chemical formula CH 4.
- Natural gas is a mixture of methane, ethane, propane, butane, and other minor gases.
- Methane normally represents 70 to 98 percent of the mixture (Hyne, 2001).
- Methane gas is non- toxic and does not cause cancer.
- *Nearly all components of natural gas are combustible.*

Methane From Where?

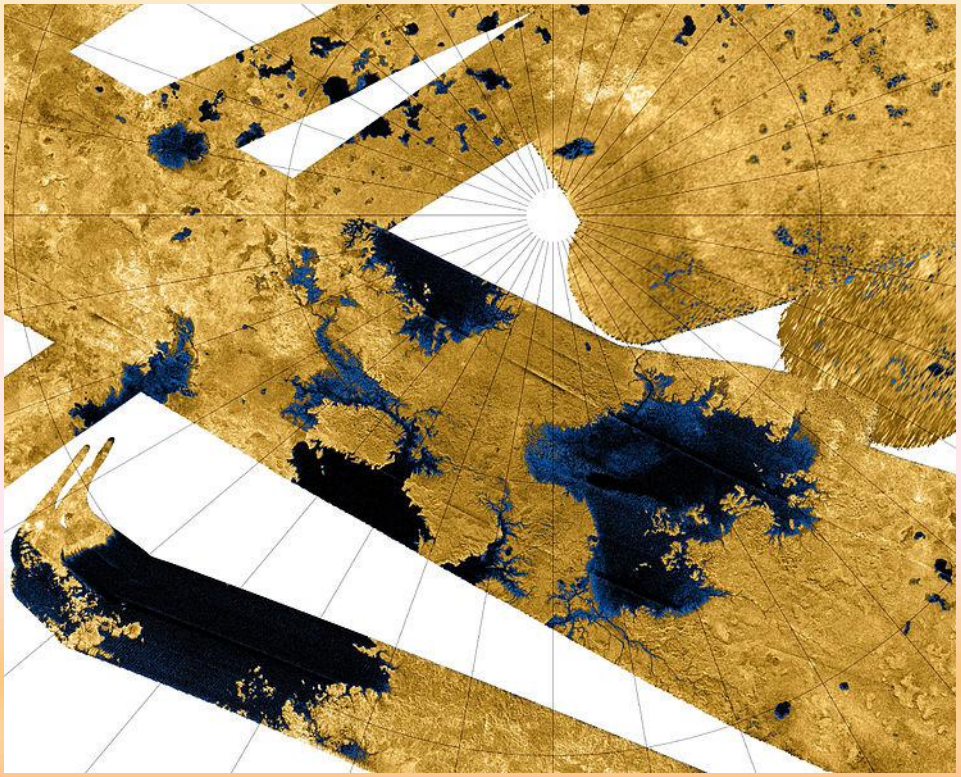
- Methane is found on other planets and moons in the solar system. However these hydrocarbon sources are not biological.

- Abiogenic formation

  Polymerization reactions?

- Saturn's moon Titan has hydrocarbon rainfall and lakes consisting of ethane and methane.

- NASA computer enhanced photo of hydrocarbon lakes on Saturn's moon, Titan.



Atmospheric Methane in the Solar System

Jupiter –about 0.3% methane

Saturn –about 0.4% methane

- Titan —contains 1.6% methane

Uranus –contains 2.3% methane

- **Earth 0.00017 %**

Methane on Earth Is Biogenic

- *However*, virtually all of the methane on Earth is of biological origin created either by two Processes:
- **Methanogenesis -** created from microbiological processes.
- **Thermogenesis –** created by heat and pressure on organic material.

Thermogenic Methane

Pressure Cooking of raw organic material while buried deep within the earth.

Petroleum source

- Associated with oil
- Migrated from oil
- Secondary cracking of oil

Methanogenic Methane

- Microbial
  - Marsh and Landfill Gas: Bacterial
  - Fermentation Reactions
  - Groundwater Gas: Reduction of Carbon Dioxide

Methane Sources

- Methane gas is found in coal beds
- Oil and natural gas formations
- Landfills
- Marshes (aka swamp gas) and
- Some glacial deposits (aka drift gas).
- Livestock

Methane in Our Atmosphere

- Methane is also a greenhouse gas
- Atmospheric methane is naturally cycled — by methane's reaction with hydroxyl radicals formed from singlet oxygen atoms and with water vapor.
- It has a net lifetime of about 8 to 10 years in the atmosphere, and is primarily removed by conversion to carbon dioxide and water.

Ohio’s Concern about Methane

- Natural gas or methane that is released *naturally* from the subsurface to the surface is commonly referred to as ***stray gas.***
- Natural gas or methane that is released because of a *man-made source activity* such as an improperly sealed or abandoned oil or gas well is referred to as ***fugitive gas.***

Methane

- Methane in water wells is a relatively common occurrence in some localized areas of Ohio and is not a new phenomenon.

Methane

- Methane gas is non- toxic
- Not poisonous
- Does not cause cancer.
- The US EPA does not list methane as either a primary or secondary ground water contaminant.

Methane Guidance

- Methane is a safety hazard – explosive limits in confined areas and asphyxiation
  - LEL – lower explosive limit – 51,000 mg/l or 5.1% volume by air up to 15%
  - Asphyxiant when it replaces oxygen in an enclosed area at a concentration of over 50% in air.

Ohio has adopted a Methane Standards for Private Water Systems

- Ohio Administrative Code Chapter 3701-28-10 (O) requires that wells that produce methane greater than 10 mg/l shall be vented to the atmosphere to prevent explosive conditions and minimize human health exposures
- Based on action levels recommended by Office of Surface Mining Reclamation and Enforcement (2001)
- No current standard for free gas detections

Dissolved Methane

Ohio’s private water system regulation is based on dissolved methane in water.

Not free methane gas

Methane Guidance

- Phases of methane in ground water – free gas or dissolved
- Symptoms of methane in water supply – spitting, fizzing, bubbling, cloudy water, increased turbidity

Dissolved Methane

- Maximum concentration of methane dissolved in water at **standard atmospheric pressure (1 atmosphere)** at 68 degrees F is **28 mg/l.**
- Dissolved methane levels may be higher when water is pumped from deeper aquifers *under higher pressure conditions* (up to about 180 mg/l).
- The gas exsolves (comes out of solution) from the water when it reaches the saturation point.

Gas Phase

- Methane can also be released from a gas containing formation and bubble-up the water column in a well *without* becoming dissolved in the water.

The methane may off-gas directly out of the top of the well or,

if there is not adequate ventilation at the well head may enter the home through a faucet.

- Although pure methane is colorless, odorless, and tasteless….
- Unprocessed natural gas from oil and gas producing formations does have an odor since it is not pure methane. The odor from natural gas comes from the other gases present in the mixture and does not smell the same as natural gas sold to consumers.
- Natural gas sold to consumers is treated with a chemical odorant called *mercaptan*. The mercaptan gives the gas a consistent, distinctive odor for safety reasons in case of a leak.

Methane Guidance

- Methane is a safety hazard – explosive limits in confined areas and asphyxiation
  - LEL – lower explosive limit – 51,000 mg/l or 5.1% volume by air up to 15%
  - Asphyxiant when it replaces oxygen in an enclosed area at a concentration of over 50% in air.

Methane Guidance

- *Suggested* action levels for detections of methane gas in homes base on % in air:

Action Level	Atmospheric	
	Occupiable Space	Unoccupiable spaces
Immediate Action – active venting/treatment	>1%	>3%
Warning – investigate/vent	>0.5% to <1%	>1% to <3%
Monitor for trends	>0.25% to <0.5%	
No immediate action	<0.25%	<1%

Based on OSMRE (2004)

Methane Guidance

- How is methane detected in homes?
  - by either collecting a sample of the water and analyzing for dissolved methane at a qualified laboratory,
  - or by using a gas detector to determine the percentage or mg/l (volume) of methane in the air within a confined structure when water is running, at the well vent, or the headspace of the well when the cap has been removed.

Methane Guidance

- What types of
- equipment are used
- to detect natural gas?
  - Mobile hand held
  - detection meters

  - Wall mounted
  - detections systems
  - for homes

High precision gas detector

ODNR - Expert Panel Report Bainbridge Township Subsurface Gas Invasion 7/7/10

What areas should be checked for natural gas?

- Area around the well casing and cap – both prior to, during and after pumping
- All rooms in the home and in the area housing the any water systems equipment

Wellhead LEL measurement

Methane Guidance

- Who can be contacted to check for methane???
  - Some Fire departments that have gas detection meters. *(Most Fire Departments do not have meters)*
  - Private labs or consulting companies for collection of water samples.
  - ODNR ??
  - ODNR will check only water wells that may have been impacted by oil and gas drilling activity.
    - *Catch…ODNR staff are the most qualified experts to determine methane source.*

*Local health departments **do not** check for methane gas but some are collecting water samples for dissolved methane.*

Water Sampling for Methane

- Methods for water quality analysis for dissolved methane
- Standard Method 6211
- EPA 3810, RSK 175 (laboratory procedure)

- The Ohio EPA currently does not certify an analysis method for dissolved methane in water.
- ODH Recommends using a lab that has national (NELAP) certification.

(NELAP) Certification for Methane Analysis

- The Pennsylvania Environment Department (PA DEP)
- “The method is now called, officially, PA-DEP 3686, Rev. 0, but no laboratory is accredited for the method by that name. It shows up on PA DEP laboratory scopes as PA DEP Methane/Ethane. “
- Based on the previously mentioned methods and procedures.
- Only **one laboratory located in Ohio** currently has NELAP Certification
  - Test America

NELAP Certification Information

- Virginia Hunsberger | Laboratory Accreditation Officer
- Department of Environmental Protection | Bureau of Laboratories
- Laboratories Building
- PO Box 1467 | Harrisburg, PA 17105
- 2575 Interstate Dr. | Harrisburg, PA 17110
- Phone: 717.346.8211 | Fax: 717.346.8590
- www.depweb.state.pa.us

Accredited Labs for Matrix: NPW - Analytes: 69 Methane

Lab ID:	Organization	Primary Contact	Phone	Issue / Expiration Date
00293	ALS - Middletown	Anna Milliken	(717) 944-5541	1/20/2012-1/31/2013
00786	ALS Columbia Analytical Services	Michael Perry	(585) 288-5380	5/17/2012-6/30/2013
04992	ALS Laboratory Group, USA	Joe Credeur	(281) 530-5656	1/26/2012-2/28/2013
00401	Benchmark Analytics Inc	Fiona Adamsky	(610) 974-8100	12/16/2011-1/31/2013
00237	Environmental Laboratory Services Inc	Marianne Whipkey	(724) 652-5770	12/16/2011-1/31/2013
02979	Environmental Science Corp dba ESC Labsciences	Judith R. Morgan	(615) 773-9657	11/17/2011-12/31/2012
00382	Environmental Service Laboratories Inc	Anngela Chapman	(724) 463-8378	5/1/2012-6/30/2013
00062	Fairway Laboratories Inc	Michael Tyler	(814) 946-4306	10/17/2011-9/30/2012
00306	Geochemical Testing	Timothy W. Bergstresser	(814) 443-1671	12/1/2011-1/31/2013
00350	H2M Labs Inc	Joann M. Slavin	(631) 694-3040	6/4/2012-7/31/2013
00463	Hampton - Clarke/Veritech	Stanley E. Gilewicz	(973) 244-9770	9/29/2011-11/30/2012
00417	HawkMtn Labs Inc	Jeff Gittleman	(570) 455-6011	4/24/2012-4/30/2013
00773	Integrated Analytical Laboratories, LLC	Michael Leftin	(973) 361-4252	6/20/2011-7/31/2012
00037	Lancaster Laboratories Inc	Duane Luckenbill	(717) 656-2300	1/20/2012-1/31/2013
00213	Mahaffey Laboratory LTD	Carlton R. McCracken Jr.	(814) 236-3540	7/7/2011-7/31/2012
01670	Microbac Laboratories Inc Ohio Valley Division	David Vandenberg	(740) 373-4071	5/4/2012-6/30/2013
00538	Microseeps Inc	Ruth Welsh	(412) 826-5245	9/28/2011-11/30/2012
30223	PA DEP Bureau of Laboratories	Martina McGarvey	(717) 346-8618	9/27/2011-9/30/2012
00034	Seewald Laboratories Inc	Raymond (Ray) Martrano	(570) 326-4001	1/26/2012-1/31/2013
00328	Stewart Laboratories Inc	Lee Stewart	(814) 379-3663	10/21/2011-10/31/2012
04085	TestAmerica Austin	Carl W. Skelley	(512) 310-5208	10/19/2011-10/31/2012
00281	TestAmerica Buffalo	Christopher Spencer	(716) 504-9852	7/6/2011-7/31/2012
00585	TestAmerica Laboratories Inc	Michael H. Dunn	(615) 726-0177	5/24/2012-6/30/2013
00340	TestAmerica Laboratories Inc TestAmerica North Canton	Opal Davis-Johnson	(330) 497-9396	8/15/2011-8/31/2012
00416	TestAmerica Laboratories Inc dba TestAmerica Pittsburgh	Debbie Lowe	(412) 963-7058	3/20/2012-4/30/2013
00474	TestAmerica Laboratories, Inc. - Savannah	Benjamin Gulizia	(912) 354-7858	5/1/2012-6/30/2013
04471	Trace Analytical Laboratories Inc	Gina Roe	(231) 773-5998	3/23/2012-3/31/2013
01629	Vaportech Services Inc	David J. Masdea	(724) 898-2622	2/1/2012-3/31/2013

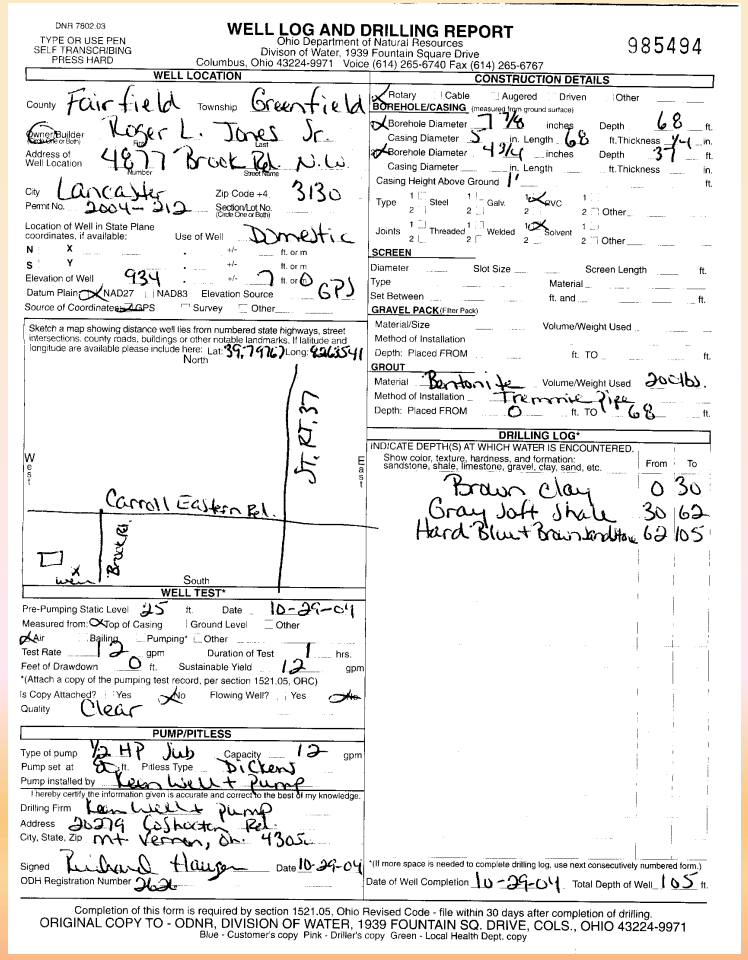
Number of Labs: 28

Sampling for Dissolved Methane

- It is very difficult to obtain consistent accurate results for dissolved methane.
- Weather can effect methane results
- Can create wide variations in data.
- Results can be effected by barometric pressure.
- And outdoor temperature

Information to collect prior to sampling

- Well log record
  - Total depth of well
  - Type of aquifer
  - Historical static water level
  - Reported well yield



DNR 7802.03

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT
Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6740 Fax (614) 265-6767

985494

WELL LOCATION

County Fairfield Township Greenfield
Owner/Builder (Name One or Both) Roger L. Jones Sr.
Address of Well Location 4877 Brook Rd. N.W.
City Lancaster Zip Code +4 3130
Permit No. 2004-212 Section/Lot No. (Circle One or Both)
Location of Well in State Plane coordinates, if available: Use of Well Domestic
N X . +/- ft. or m
S Y . +/- ft. or m
Elevation of Well 934 . +/- 7 ft. or 0
Datum Plain ☒ NAD27 ☐ NAD83 Elevation Source GPS
Source of Coordinates ☒ GPS ☐ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: 39.79767 Long: 8263541

CONSTRUCTION DETAILS

☒ Rotary ☐ Cable ☐ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)
☒ Borehole Diameter 7 7/8 inches Depth 68 ft.
Casing Diameter 5 in. Length 68 ft. Thickness 1/4 in.
☒ Borehole Diameter 4 3/4 inches Depth 37 ft.
Casing Diameter in. Length ft. Thickness in.
Casing Height Above Ground 1' ft.
Type 1 ☐ Steel 1 ☐ Galv. 1 ☒ PVC 1 ☐ Other
Joints 1 ☐ Threaded 1 ☐ Welded 1 ☒ Solvent 1 ☐ Other

SCREEN
Diameter Slot Size Screen Length ft.
Type Material
Set Between ft. and ft.

GRAVEL PACK (Filter Pack)
Material/Size Volume/Weight Used
Method of Installation
Depth: Placed FROM ft. TO ft.

GROUT
Material Bentonite Volume/Weight Used 200 lbs.
Method of Installation Tremmie Pipe
Depth: Placed FROM 0 ft. TO 68 ft.

DRILLING LOG*
INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.
Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.

	From	To
Brown clay	0	30
Gray soft shale	30	62
Hard Blue + Brown sandstone	62	105

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10-29-04 Total Depth of Well 105 ft.

WELL TEST*
Pre-Pumping Static Level 25 ft. Date 10-29-04
Measured from: ☒ Top of Casing ☐ Ground Level ☐ Other
☒ Air ☐ Bailing ☐ Pumping* ☐ Other
Test Rate 12 gpm Duration of Test 1 hrs.
Feet of Drawdown 0 ft. Sustainable Yield 12 gpm
*(Attach a copy of the pumping test record, per section 1521.05, ORC)
Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No
Quality Clear

PUMP/PITLESS
Type of pump 1/2 HP Sub Capacity 12 gpm
Pump set at 8 ft. Pitless Type Dickens
Pump installed by Kean Well + Pump

I hereby certify the information given is accurate and correct to the best of my knowledge.
Drilling Firm Kean Well + Pump
Address 20279 Coshocton Rd.
City, State, Zip Mt. Vernon, Oh. 43050
Signed Richard Hauger Date 10-29-04
ODH Registration Number 2626

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971
Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

Methane Water Sampling Protocol *Suggested* by Chesapeake Energy Corporation
Gas Company

- Jody C. Jones
- Manager, Environmental and Regulatory Affairs
- Chesapeake Energy Corporation

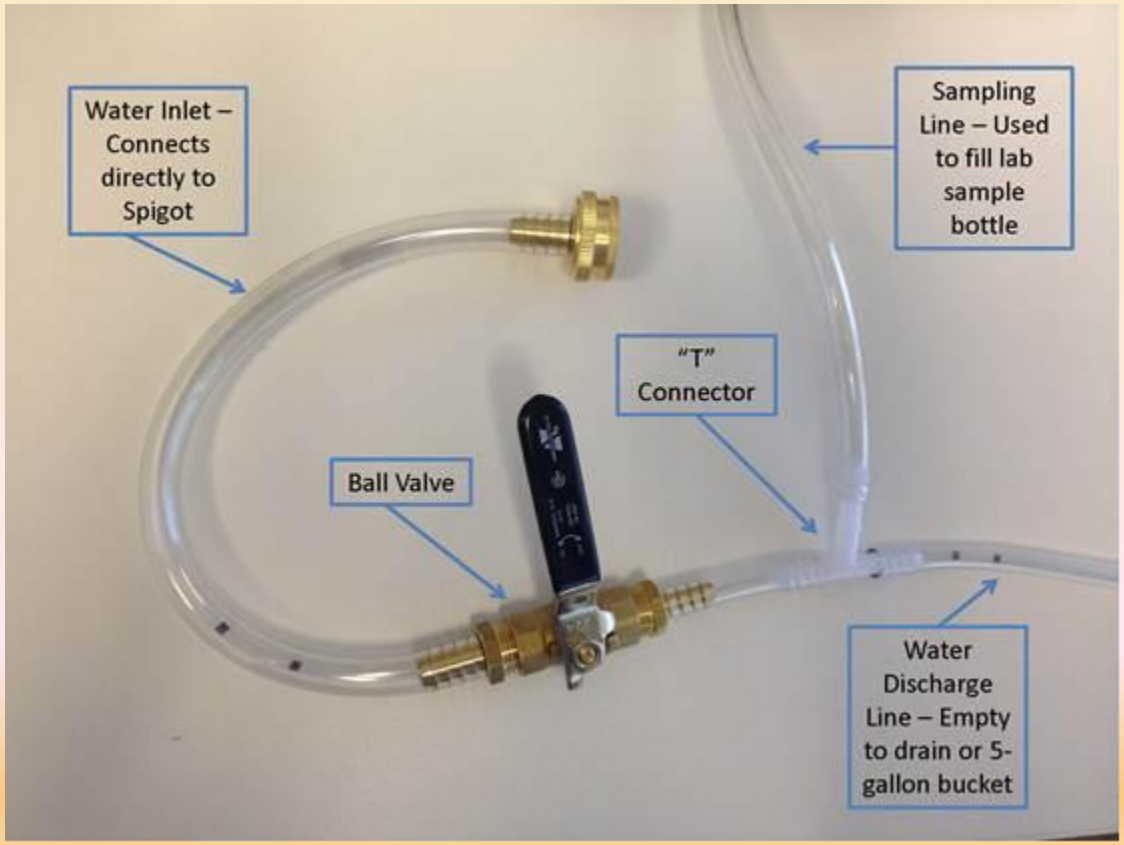
Suggested collection 3.4.2.1 Method A (Primary Method)

- This method is for most samples, including samples that will be collected from wells using pumps and to collect *effervescent samples*.
- It is recommended that samples be retrieved from wells using either permanent pumps or temporary sampling pumps.
- Bailers *cannot* be used to collect samples under this method.

Suggested Sample Collection Method

- Use of a sampling manifold consisting of a flow splitting device with a sample flow valve is recommended.
- The manifold (tubing, “T”, and valve) may be properly decontaminated between sampling different water sources.
- The pump discharge or tap is connected to one side of the tubing (water inlet) and connected to the “T”. The tubing on the opposite side of the “T” includes a sample flow valve and is the water discharge line.
- The base of the “T” is connected to smaller tubing, of sufficient length and diameter to place inside the VOC vial or other sample container which will be submerged upside down in the bucket during sampling.
- The water faucet and sample flow valve are adjusted so that flow through the sample tubing is less than 500 milliliters per minute (500 ml/min). The diagram below depicts the described sampling manifold. Similar devices that accomplish the same purpose may also be used.

Suggested Sample Collection Method: Dissolved Gases Water Sampling Manifold



Suggested Sample Collection Method

- The samples should be collected in unpreserved 40-ml volatile organic analysis (“VOA” or volatile organic compounds (VOC)) vials equipped with a Teflon gas-tight septum (methane, ethane, propane analysis) or other specialized containers supplied by the laboratory (isotopic analysis).
- Collection of a minimum of 3 VOC vials is recommended.
- Due to the volatility of methane, samples should be collected under head to avoid excessive loss of methane during sampling and to ensure repeatable data.

Suggested Sample Collection Method

- To collect dissolved gases, sample from a tap or sampling pump:
- After the well has been sufficiently purged, fill a clean, properly decontaminated 5-gallon bucket or similar container (bucket) at least ½ full with water from the tap and set aside. During sample collection the sampler should take care not to overfill the container or should collect samples where overflow will not create issues with the landowner.

Suggested Sample Collection Method

- Once the sample manifold is in place and flow has been properly adjusted, submerge an unopened, unpreserved VOC vial or other appropriate sample container to the bottom of the bucket.
- While under water, place the sample container upside down and open it with the top of the container facing the bottom of the bucket, insert the sample tubing until it reaches the bottom of the VOC vial.
- After sufficient flow to displace twice the volume of the container has occurred (approximately 10 seconds for a flow rate of 500 ml/min for a 40- ml VOC vial) the tubing should be removed from the container and the cap should be immediately replaced.

Suggested Sample Collection Method

It is important to avoid displacing more than two 40 ml volumes during sampling as this may result in off-gassing methane to create headspace in the sample container, potentially biasing the analytical results.

The container should not be removed from the bucket until the cap has been adequately tightened This technique keeps the dissolved methane trapped under the pressure head of the water so that the sample collected has not had an opportunity to degas.

Dissolved Isotopic Gases Sampling for Water Samples

- Specialized bottleware is needed for isotopic and compositional methane analysis.

- At this point of an investigation this analysis will be used by ODNR or the oil and gas company to help determine specific methane source.

Sealed System Sampling Manifold for Isotopic Effervescing Samples

3.4.2.2 Method B Alternate Method
-Typical of VOC collection method

- ***Method B is only to be used when conditions prevent collection of samples using Method A.*** This method should **not** be used to sample effervescent water or water known to have high bicarbonate content because the sample preservatives can cause the sample to degas and lose methane.
- Samples are collected in 40-ml glass VOA vials equipped with a Teflon gas-tight septum containing appropriate acid preservative. Collection of a minimum of 3 VOA vials is recommended.

Method B Alternate Method -Typical of VOC Collection Method

The sample should be collected slowly by allowing the water to run down the tilted side surface of the vial.

As the vial fills, straighten the vial to an upright position and continue filling until an upward meniscus develops along the upper edge of the sample vial.

Remove any bubbles floating on the top of the meniscus with the vial cap, and seal the vial.

Avoid overfilling the vial to prevent loss of the acid preservative. A vial that is overfilled should be properly discarded and a new sample should be collected.

Sample transport

- The VOA (VOC) vials or other sample containers should be secured in an insulated shipping container (ice chest) filled with wet ice, and transported to the laboratory for either same day or overnight delivery.

Methane Guidance

- How are water samples reported?
  - As mg/l dissolved methane
  - Maximum concentration of methane dissolved in water *at standard atmospheric pressure* at 68 degrees F is 28 mg/l
  - Dissolved methane levels may be higher when water is pumped from deeper aquifers under higher pressure conditions (up to 180 mg/l)

Methane Guidance

- How are methane concentrations reported in air?
  - Percentage of air by volume or milligrams of methane per liter of air
- Relationship between dissolved methane levels and percentages of methane in air
- Explosive hazard will vary depending on the volume of space, the volume of water pumped and the ventilation of the space

How are methane (natural gas) concentrations reported in air?

- Gas concentrations are also commonly referred to in percentage of air by volume (%) or milligrams of methane per liter of air (mg/l) (which is the same as a part per million). The following examples indicate how to convert between mg/l in the air and per cent in the air by volume. The lower explosive limit (LEL) is the minimum amount of a gas in the air that can cause an explosion.

How are methane (natural gas) concentrations reported in air?

- 1. Convert mg/l to % - A milligram per liter (mg/l) is the same as one part per million (ppm). The percent of one million is calculated by dividing the mg/l by 10,000.
- To determine the % of methane in air, you divide the mg/l of methane by 10,000.

- Example 1. 5 mg/l ÷ 10,000 = 0.0005%
- For methane, this percentage is well *below* the lower explosive limit of 5.1%.

- Example 2. 50,000 mg/l ÷ 10,000 = **5 % *which is the lower explosive limit (LEL).***

Convert % In Air to mg/l Methane in Air

- 2. Convert % in air to mg/l methane in air.

- Example 1. 15% x 10,000 =150,000 mg/l which is the upper explosive limit (UEL).
- Example 2. 78% x 10,000 = 780,000 mg/l which is above the explosive limit and will not explode but is beyond the asphyxiant level.

How are methane (natural gas) concentrations reported in air as LEL?

- The per cent of methane gas in the air is not the same as the percent of the lower explosive limit.
- Fire departments and gas companies read their meters based on the percent of the LEL.
- A methane level that is 100% LEL is greater than 50,000 ppm of methane detected with a gas detection meter. 1% LEL is approximately equal to 500 ppm and is not explosive.

Methane Mitigation – Key Issues

- When substantial methane is suspected …
- Since occurrence and concentration of methane will likely vary with time, current weather and barometric pressure, and seasonal changes in ground water levels
- more than one sample should be collected to determine the range in dissolved methane or free gas concentrations to adequately size venting or treatment.
- At lower levels, simple venting methods may be tried with progression to more complex venting or treatment as necessary.

Methane Standards for Private Water Systems

- Private water system must be vented using one of the following:
  - Vented cap extended to height to prevent combustion from normal household activities
  - Use of gas shroud sealed to the top of a submersible pump
  - Use of whole house aeration system
  - Wells located in basements or other similar structures must be vented to the outside with specifications for venting

Methane Mitigation

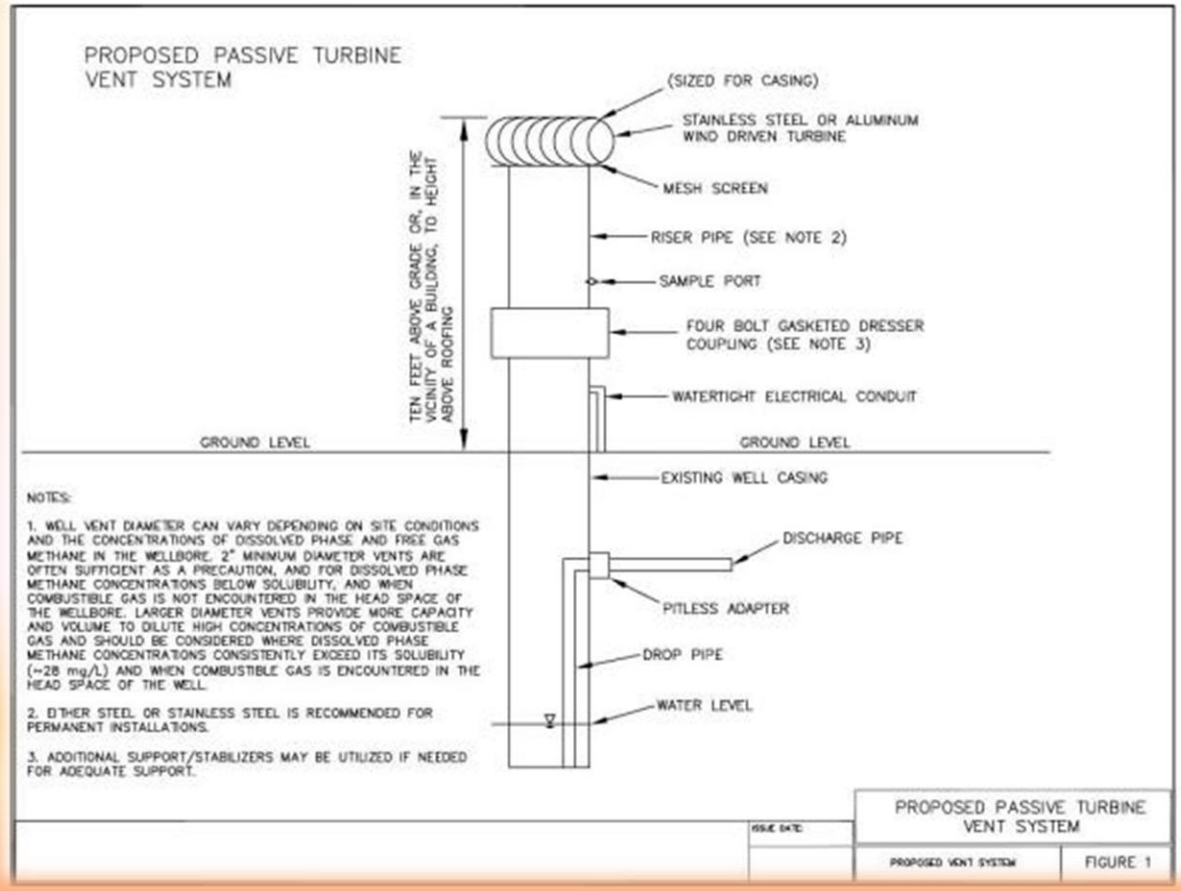
- Ohio rules require a permit from the local health district to install water quality treatment equipment (for contaminants) or alter a private water system
- Installation must be performed by a registered private water systems contractor
- A follow up inspection and water sample will be collected by the local health district after installation of venting equipment

Methane Mitigation – Low Levels < 2 mg/l

1. **Passive venting –**
   - Passive venting through a vented well cap may work to reduce methane levels where no prior venting has been installed.
   - The vent diameter may be no less than one inch in diameter, and the vent opening must be screened and extend to a height to prevent combustion from normal activities around the home (lighting grills and cigarettes).
   - Wells with buried seals should be extended above grade, wells located in basements or basement offsets should be vented outside.
   - Wells located in well pits should be extended above grade or at least have vents extended above the well pit cover.

Recently reviewed and approved for Private Water Systems

- Passive Turbine Venting



Other Possible Remediation Steps

- Use well log information or a down-hole camera survey (with pumping) to determine where methane is entering the well if possible
  - If the methane is from a lower geologic formation, seal the well back past the methane producing zone using neat cement or concrete
  - If methane is produced from a shallow geologic formation, install additional casing past the producing zone if possible and grout the casing using neat cement or concrete

Contact Information

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Fax (614) 466-4556

Brandon Mantel

Donamarc Water Systems Co.

- Methane Mitigation Systems

Methane Mitigation – Low Levels < 2 mg/l

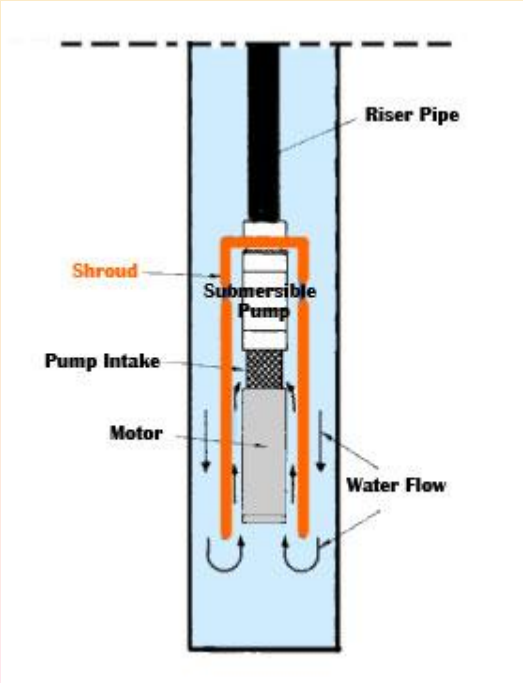
2. **Retention tank for warming the water –**
   - Ground water in Ohio has an average temperature of 51-52 degrees Farenheit, and methane vents slowly from colder water.
   - A 120 gallon retention tank in a basement or other area that reaches normal room temperatures can be used to warm the water and improve the rate of ventilation of methane.
   - The retention tank must be vented to the outside air with a vent diameter of no less than one inch, and the vent opening must be screened and extend to a height to prevent combustion from normal activities around the home (lighting grills and cigarettes).

Methane Mitigation – Low Levels < 2 mg/l

3. Installation of a gas shroud –

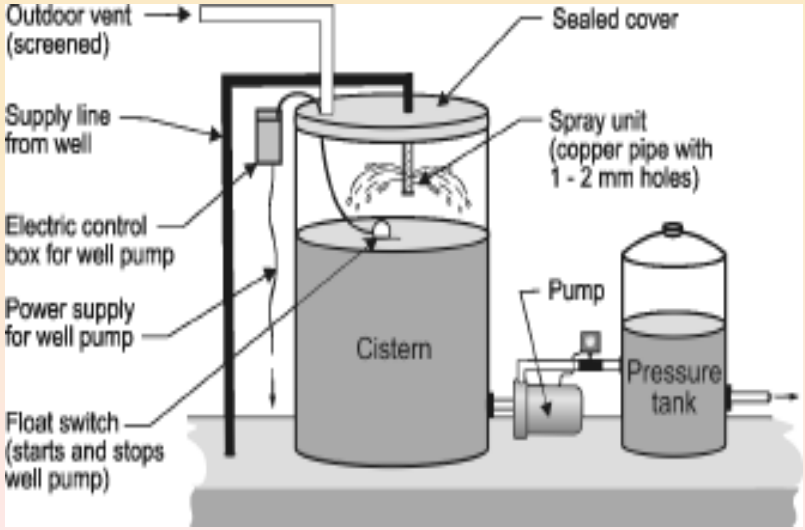
- A gas shroud installed over a submersible pump will primarily reduce pump locking issues –

  although…
- Gas shrounds may not be reliable due to cold temperatures of ground water in Ohio.
- A PVC pipe or a piece of casing is installed from the top of the submersible pump motor, 10 or more feet above the pump.
- The shroud is sealed at the top of the submersible pump motor below the pump intake. The top of the shroud is open and set below the pumping water level.
- As methane rises through the water column in the well, some of the dissolved methane bypasses the pump intake, reducing the amount of methane in the water that is drawn into the home.
- This method works primarily on 6-inch or larger diameter wells with standard well pumps, and wells that pump relatively small quantities of water at one time.



Methane Mitigation – Moderate to High Levels > 2 mg/l

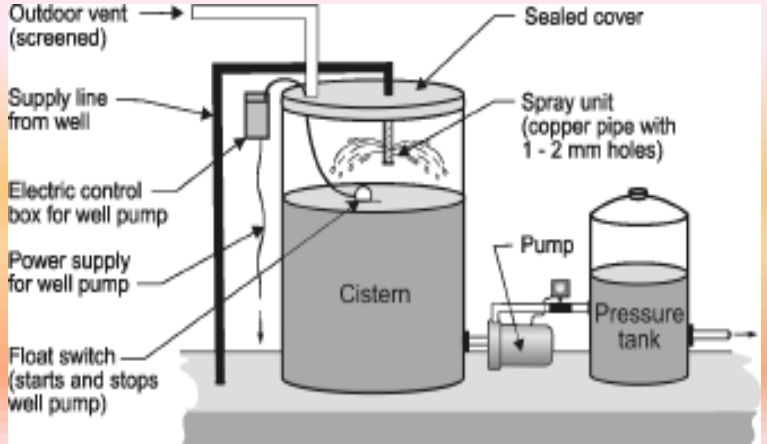
- A spray aeration system is the most reliable way to eliminate methane but it is also the most expensive option.
- A spray aeration system **must be installed and maintained in a warmer environment at >45 degrees Farenheit.**
- **The water temperature must be above 58 degrees to gain complete dissolved methane removal using aeration methods.**



Source: Alberta Agriculture and Rural Development, Dissolved Gases in Well Water

Methane Mitigation – Moderate to High Levels > 2 mg/l

- Spray aeration systems spray the water in a fine mist using a spray bar or nozzle inside an enclosed tank.
- The methane gas separates from the water during the spray process and is vented via a vent pipe with screen and flap valve to the atmosphere to an elevation above the roof of the house or building.
- The aeration system can be installed prior to the pressure tank or after the pressure tank and the system is repressurized by another pump to provide adequate water pressure in the home. A check valve is required after the pressure tank.
- The aeration process may also oxidize out some dissolved constituents such as iron or sulfur that will precipitate particles that may require filtration. In some cases, additional continuous disinfection may be needed since there can be additional bacteria growth due to atmospheric mixing of the water.



Private Water Systems Contractor Training

- ODH is partnering with the Ohio Water Well Association to develop training for local health district sanitarians and well contractors
  - Guidance document information
  - Methane mitigation options
  - Installation procedures and follow up inspections/sampling

Well Owner Fact Sheets

- Develop series of well owner fact sheets on:
  - Methane occurrence as a stray gas
  - Detection and sampling methods
  - Action levels and venting requirements
  - Mitigation methods and working with a private water systems contractor

Well Owner Outreach

- Use of web and social media
- Dissemination of information through local health districts and private water systems contractors
- Partner with OSU Cooperative Extension and develop well owner training and outreach

Resources

- ODNR, Division of Oil and Gas Resources Urban Drilling well sampling requirements
- Recommended sampling parameters – Mahoning and Columbiana County
- Other state recommendations – Pennsyslvania, New York, West Virginia
- Published literature
- US Geological Survey
- Industry voluntary sampling list