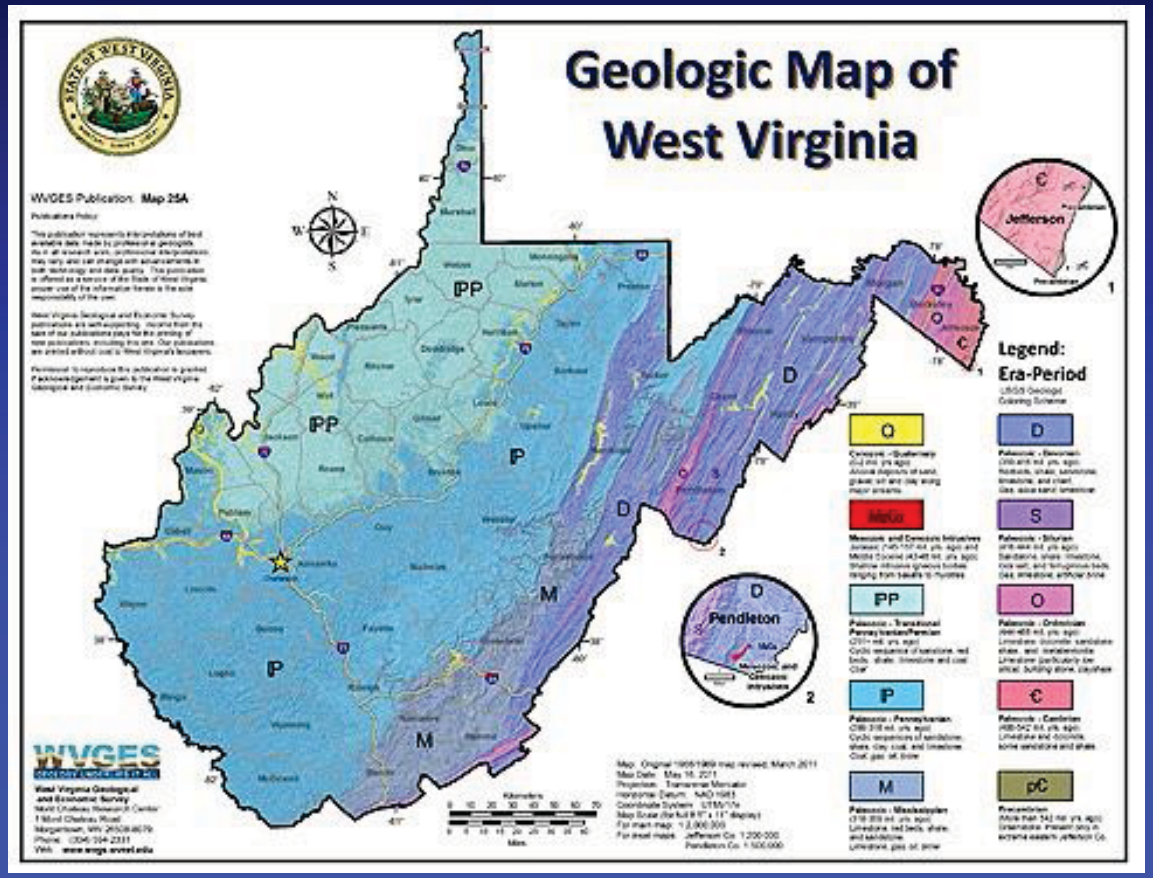
The West Virginia Approach
Working as a Community



Source: West Virginia Geological and Economic Survey
http://www.wvgs.wvnet.edu/

Getting The Waters Tested
Types of Water Testing

Step 3
Follow-up
Certified Testing

Step 3
Follow-up
Certified Testing

Step 1-Third-Party Sampler
and Certified Testing

Screening Tests
or Self-Monitoring

Step 2- Screening

Citizen Science
And Remote Monitoring

Baseline Testing – Just the Facts

Document

- For permission – Contact Mr. Brian Oram, PG
- bfenviro@ptd.net
- 570- 335-1947

http://www.bfenvironmental.com

http://www.water-research.net

Presented by:

Mr. Brian Oram, Professional Geologist (PG),
Soil Scientist, Licensed Well Driller
B.F. Environmental Consultants Inc.

http://www.bfenvironmental.com

Water Research Center

http://www.water-research.net

Prepared For

West Virginia Surface Owners'
Rights Organization
1500 Dixie Street
Charleston, WV 25311

B.F. Environmental Consultants Inc.

- Professional Consulting Services in the areas of water quality, soils, stormwater, geology, aquifer analysis, and land-development.
- Baseline – Chain-of-Custody
- Expert Testimony
- Water Treatment Process/ Product Development
- http://www.bfenvironmental.com

Water-Research Center

Education and Outreach Program funded by

B.F. Environmental Consultants Inc.

Outreach Programs

- Environmental and Professional Education and Training for Citizens and Local Municipalities
- Water Quality Help Guides – Information Library
- Community and Business Outreach Programs
- Low Cost – Informational Water Testing Program with National Laboratory
- Citizen Monitoring Programs

Website: http://www.water-research.net

WATER RESEARCH CENTER

Current Programs

- Free Assistance in Reviewing Baseline Data for Private Well Owners
- Free Website with Information on Water Quality Problems with Case Studies
- Educational Materials and Educational Presentations
- Training Program for Baseline Samplers
- Go to http://www.water-research.net

Target Audience

- Stakeholders
- Private Well Owners
- Community Advocates and Scientists
- Health Related Professionals
- Municipal and Local Officials
- Water Supplies and State Regulators

EPA Sampling In Dimock

Recent Site Tour- Towanda, PA

I took both photos – First Time on the Drilling Platform and first time watching the EPA Sample.

WATER RESEARCH CENTER

Definitions Related To the Process

- Certified – a laboratory that has been certified by the state or through a National Certification Process (NELAC). The laboratory should be "Independent" from the Oil and Gas Company, i.e., it can not be a sister company or a subsidiary.
- Chain-of-Custody – this is the process that should be used to ensure the data that is generated is valid and can be used in a legal proceeding.
- Third-party Sampler – either an employee of the certified laboratory or other professional with no vested interest in the results. This can not be a friend, relative, or an employee of a gas company, but it could be a paid consultant.

http://www.bfenvironmental.com

http://www.water-research.net

Definitions Related To Technology

- Conventional Oil and Gas Development – this is when the zone of production is from an area where the gas has accumulated over time.
- Unconventional Oil and Gas Development – this is typically a source rock with very low permeability where the gas or oil has been produced and is trapped in the pore spaces of the rock. In many cases, a small amount of the gas or oil has been produced in this zone and migrated upward to accumulate in a shallower area. These shallower areas are typically the areas for conventional gas development. Other Terms – tight oil, tight gas, shale gas, and coal-bed methane.
- Closed Loop Drilling – a more environmental sound process that does not use lined pits to manage well cuttings and drilling muds.

http://www.bfenvironmental.com

http://www.water-research.net

Definitions Related to the Well

- Lower Explosion Limit – the lowest concentration of a gas in the atmosphere that could cause ignition. This should be measured under the wellcap or at the well vent before pumping the well and while the well is pumping after collecting the baseline water sample.

- Static Water Level – the depth to water during non-pumping conditions in a water well.
  This should be measured, before the well is pumped.

- Dynamic Water Level-the depth to water in the well when the well is pumping for some period of time. This should be measured after the well has been pumped and baseline water sample collected.

- Drawdown – the Difference between the static water level and dynamic water level.

- Specific Capacity for the Well - Pumping Rate of the Well Divided by the Amount of Drawdown.

Definitions Related to Water Quality

- **Conductivity** – the ability of the water to carry a charge. The greater the conductivity the more substances are dissolved in the water. (Measure in the field)
- **BTEX** – Benzene, Toluene, Ethylbenzene, and Xylene – Components of coal tar, petroleum products, inks, paints, insecticides, solvents, and other fuels.
- **MTBE**- ***Methyl Tertiary Butyl Ether*** - was an additive in gasoline.
- **ORP**- Oxidation Reduction Potential measured in millivolts and the value can be positive or negative. The more positive, the chemical reactions in the water or oxidizing. The more negative, the chemical reactions are more reducing. This should be measured in the field during the sampling process.
  - Positive Oxidizing Conditions – may be associated with discolored water
  - Negative Oxidizing Conditions – may be associated with odors and higher methane concentrations.

http://www.bfenvironmental.com

http://www.water-research.net

Other Concepts

- Citizen Science – private citizens that conduct self-monitoring and screening for themselves or others. This data is not certified, but if individuals are trained and equipment calibrated and maintained this may be a cost effective screening tool after baseline testing or for watershed monitoring.

- Information Water Testing – some commercial laboratories and universities may offer low cost screening tests that are accurate, but not certified. This may be an affordable screening option for a homeowner– After baseline testing has been conducted.
  - One Example – http://www.check-water.com

http://www.bfenvironmental.com

http://www.water-research.net

Step 1- Baseline Testing for Private Drinking Water Source

For the Private Citizen – Baseline Water Testing Starts with a "Third Party" Sampler – Certified Water Testing .

Baseline Sampling Does Not Start with any of the following:

a. Home Screening Test
b. Water Sample Collected by the Homeowner, Friend, or an Interested Party, even if the sample is taken to a certified laboratory.

Baseline Sampling includes:

a. Third Party Sampler – unbiased with no vested interest in the results that has been properly trained and approved by the certified laboratory.
b. If hired by the homeowner, this could be a paid consultant or professional or an employee of the certified laboratory.
c. If hired by a Oil or Gas Company, it can be a paid consultant or professional or an employee of the certified laboratory – NOT an employee of the Oil/Gas Company.

Step 2: After Certified Testing with a Third Party Sampler- "Using Citizen Science"

In-home Screening Tests or Informational Water Testing Can be used to Track Water Quality and Potential Change - Work with Local Groundwater Guardian, Sourcewater Protection, or Watershed Group

This can be supplemented by including a journal of the Water appearance and other aesthetic quality.

If your field screening suggests a problem – Call Local Regulatory Agency and Conduct Follow-up Certified Testing- This Process Does Not Start at Step 2.

Baseline Testing for Surfacewater Sources

For the Private Citizen – Baseline Water Testing Starts with a "Third Party "–Water Sampler – This is Step 1.

Step 2: After Certified Testing with a " Third Party Sampler"

Conduct Field Screening Testing or Informational Water Testing to Track Change. – Citizen Science in Action Work with Local Watershed Group
This can be supplemented may including a journal of the Water appearance and other aesthetic quality.

If your field screening suggests a problem – Call Local Regulatory Agency and Conduct Certified Testing- This Process Does Not Start at Step 2.

Types of Water Sampling and Testing and Level of Legal Protection !

Private Source or Spring

- Step 1- Level 1- Certified Third-Party Baseline (Highest)
- Step 2 - Level 2- Informational Water Testing (Low)
- Step 2- Level 3- Self-Monitoring (Very Low)

Watershed

- Step 2- Level 4- Citizen Science – Community Watershed Monitoring Efforts (Very Low)
- Step 3 - Community Watershed Monitoring – Third Party Baseline Testing with Continuous and/or Community Monitoring (High)

To Protect the Community – A Private Source and Watershed Monitoring Program Should be Implemented –We Live in Communities

Lets Work as a Community !

Baseline Testing- It is Not Just About Collecting a Water Sample (published ONG Marketplace – 3/2013)

Link to Article at
http://www.bfenvironmental.com

What is Certified Baseline Testing?

- Certified Baseline Testing is a process to establish the current condition of a system prior to some proposed change or action.
- This is the Greatest Level of Protection !
- Persons or Agents Directly Involved with this Process
  - Licensed Professional and Third-Party Sampler
  - Private Well or Water Source Owner – "Witness the Process Only"
  - Certified Testing Laboratory

Certified Baseline Testing Agents Their Responsibilities

- Homeowner – May be the Client or Just Witness Sampling Process – Homeowners Can NOT Collect Samples
- Professional or other agent should provide a list of recommended parameters, plus should review the data and prepare final summary report for the Water System Owner.
- Sampler- Should be a Trained and Approved Third-Party Sampler or Licensed Professional (Approved by the Certified Laboratory)
  - Sampler Must Follow Collection and Sampling Process Specified by the Certified Laboratory.
  - Document Conditions in the Field and Prepare a Chain-of-Custody Sheet
  - Responsible for the Safe and Secure Storage of Sample Containers and Delivery of Samples to the Certified Laboratory following Chain-of Custody Processes
- Certified Laboratory – "Must be Certified for All Parameters" to be Tested, State or National Certification (NELAC)
  - Selects and Prepares Sample Containers and Collection Procedures
  - Conducts ALL or Facilitates Testing by a "Certified Laboratory"
  - Maintains Quality Control of Data and Protects Accuracy of the Data
  - Certified Laboratory generates a Laboratory Report
  - Stores the Data in a Secure Manner (Typically Up to 5 years)

Need Help Finding Assistance – Contact Us

How Baseline Testing Can Get Done

- Private Well Owners – Well Owner Hires a Third-Party Sampler or Professional to Complete this Process. (Sampler MUST be an Individual or Company with Zero Vested Interest in the Results).

- Gas Company or Other Company Pays Using a Third-Party Contractor for All Activities (Employees or Direct Agents of the Gas/Oil Company Can NOT Participate in this Process).
  - Company should give the Well Owner a copy of the report.
  - You May need to ask or make this a requirement in any agreements.

Regulatory Framework- Is Baseline Testing Required or Is it Optional?

- There are Two Answers
  - In some States, it is required by the State- Required.
  - In some leases, it is required by the lease- Required.
  - In some States, there is zero regulatory oversight (Optional).

Regulatory Framework- Is Baseline Testing Required or Is it Optional?

- The State may **require** an Individual or Company attempting to permit an activity to conduct baseline testing and/or the landowner/ royalty owner lease may require this testing as part of a lease.
  - Typically the state will specific a minimum radius around a structure.
  - The State may recommend or required a specific list of parameters and time line for initial and follow-up testing.
  - The State may assume the Permittee, i.e., Natural Gas Company, Responsible for Impact within a specific radius or time line unless data shows the problem is present pre-drilling.
  - Assumed liability may be lost if the private well owner, property owner, or water system owners does not permit the Permittee to collect water samples.

For the Private Well Owner – This is Free Testing Data !

If Someone Ask to Sample – the Answer is YES !

Is Baseline Testing Required or Is it Optional?

- The State may **recommend** an Individual or Company attempting to permit an activity to conduct baseline testing, but the royalty or landowner lease may required this testing.
  - Typically the state regulations will assume the Permittee, i.e., Natural Gas Company, liable for a given radius around the activity and a time line – Unless the Permittee Proves Otherwise – The burden is on the Permittee.
  - Assumed liability may be lost if the private well owner, property owner, or water system owners does not permit the Permittee to collect water samples.
  - Industry Group or Company may recommend a minimum listing of parameters to be evaluated.

For the Private Well Owner – This is Free Testing Data !

If an Oil and Gas Company Ask to Sample– the Answer is YES !

Are Private Well Owners Required to Conduct Baseline Testing ?

- To our knowledge, there is no requirement by a state or agency for the private owner to conduct baseline testing.
- Then why it is recommended?
  - You May Not be within the area the Permittee tests.
  - You may be concerned about an adjoining lease.
  - You May Not believe “Their” results.
  - You May Want to Test for More Parameters.
  - You want to have sufficient evidence if problems occur.
  - The Company or “They” may not do any sampling and then there is no data.

West Virginia Current Model

- There are Different Regulations for Unconventional and Conventional Oil/Gas Wells.
- Unconventional Oil/Gas
  - For Water Withdrawal Wells – All surface owners or water purveyor within 1500 feet must be contacted. Flow and Quality Tested Predrilling Required- if YOU request.
  - Gas/Oil Wells– All surface owners or water purveyor within 1500 feet must be contacted.
    - The Oil and Gas Company is presumed responsible for events occurring within 1500 feet of the wellhead and 6 months.
    - You can lose this protection if you do not permit the Oil and Gas Company to conduct predrilling baseline testing.
  - To our knowledge, there is no requirement for post-drilling testing unless it is part of a complaint.
  - If you are outside 1500 foot radius, you may need to contact the oil/gas company or conduct this testing on your own.
  - WV-DEP may propose special testing standards for Karst (Areas with Sinkholes) Regions

If the Oil and Gas Company – Will Not Conduct Testing for YOU and they are Drilling within about 0.5 to 1 mile of you and driving on the roads near Your Home Get Some Level of Baseline Testing Done NOW.

West Virginia Current Model

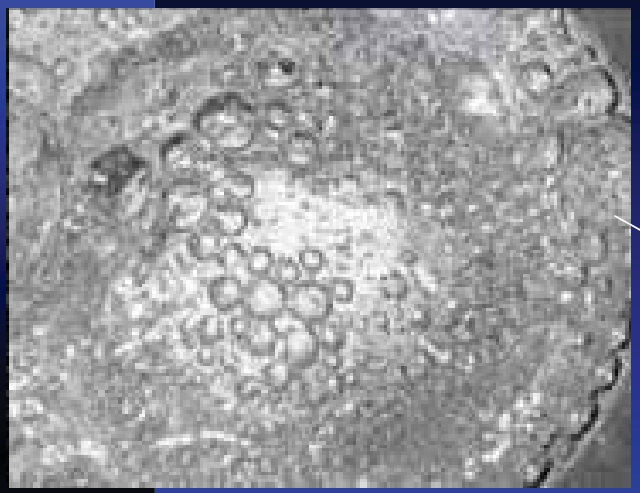
- There are Different Regulations for Unconventional and Conventional Oil/Gas Wells.
- Conventional Oil/Gas
  - All surface owners and owners of water wells or developed springs within 1000 feet must be contacted.
    - The Oil and Gas Company is presumed responsible for events occurring within 1000 feet of the wellhead.
    - You can lose this protection if you do not permit the Oil and Gas Company to conduct predrilling baseline testing.
  - To our knowledge, there is no requirement for post-drilling testing unless it is part of a complaint.
  - If you are outside 1000 foot radius, you may need to contact the oil/gas company or conduct this testing on your own.

If the Oil and Gas Company – Will Not Conduct Testing for YOU and they are Drilling within about 0.5 to 1 mile of you and driving on the roads near Your Home Get Some Level of Baseline Testing Done NOW.

If A Private Well Owner is Hiring a Professional – Some Suggestions

- For a Private Citizen - The Key Components of Baseline Testing include:
  - Implementing a process that is accurate, precise, and that generates data that can be used in potential future litigation;
  - Accurately documenting the pre-existing conditions of the system;
  - Selecting parameters that will document existing conditions, cover potential changes, and address individual system owners concern;
  - Follows a chain-of-custody process to ensure the accuracy, reliability, and integrity of the data; and
  - Utilizes a third party unbiased sampler that is experienced to ensure the protocols for collecting, preserving, and submitting the samples to the certified laboratory are followed.
  - Maintain 2 copies of the final report in a Secure Area.

Do Not End Up Here !
Do Not Put the Burden of Proof on Yourself !

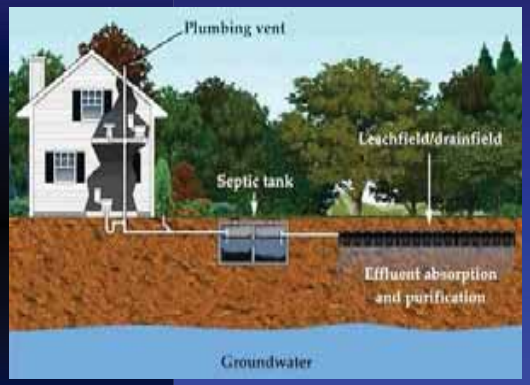


Which Is the Before Sample?

Water Issues

1. Lake House that is not regularly used and in most cases the homeowners did not drink the water.
2. No baseline testing other than some historic testing for coliform bacteria and nitrate.
3. The water appeared to change and get a salty taste and there were some gas bubbles.
4. Well - no drilling log- located in a river valley near a lake - over 400 feet deep.
5. Methane Determined to be 15 mg/L with elevated Chloride, Hardness, and Barium

If Baseline Testing Was Done
We Would Have Proof of the Impact
Now - This will have to be settled in Court
Burden of Proof May be on the Well Owner !



Your Well

Baseline Testing Should Include ALL Likely Impacts

West Virginia Model – Conventional Gas and Oil

- Restricts drilling within 200 feet of an existing water well or dwelling without the written consent of the owner.
- State Suggested Baseline Parameters - pH, iron, total dissolved solids, chloride, surfactants, methane, and coliform, plus other parameters determined by the operator.
- Our Only Comment – this is completely inadequate and will not address some of the most likely potential impacts.
- We would strongly recommend testing for additional parameters.

Source- Based on a review of Oil and Gas Law for West Virginia by Mr. Brian Oram on April 2013.

WV Model – Unconventional Gas and Oil

- Requires horizontal wells to be located at least 250 feet from a water well or spring, 625 feet from an occupied dwelling or large cattle or poultry barn, and 100 feet from a perennial stream, lake, pond, reservoir or wetland, and 1,000 feet from a public water supply intake.
- Special Provisions may be proposed for Drilling in Karsts Area (HB 401, Section 22-6A-3a)
- Driller Presumed Responsible (Section 22-6A-18) , but this only applies when
  - Freshwater sources is 1500 feet from center of the well pad.
  - Problem Occurs within 6 months of completion of drilling or other alterations.
  - Landowner did not prevent the collection of a predrill or prealteration water sample.
- State Suggested Baseline Parameters
  - Total Petroleum Hydrocarbons (GRO, DRO, ORO), BTEX, Chloride, Sodium, Total Dissolved Solids, Aluminum, Arsenic, Barium, Iron, Manganese, pH, Calcium, Sulfate, MBAS (Detergents), Methane, Ethane, Butane, Propane, bacteria, plus other parameters determined by the Operator or Chief.

Parameters missing from the list – Nitrate, Total Hardness, Bromide, Strontium, Conductivity, ORP, Total Suspended Solids, Odor, Alkalinity, Potassium, Lithium, and Turbidity.

Our Suggested Baseline- For Citizens

- **Permit the Oil and Gas Company to Collect a Predrill or Prealteration Sample. DO NOT Lose the Assumption of Responsibility Provision.**

- **Testing Package # 1 Recommendations – Document Lower Explosion Limit (LEL) and Static and Dynamic Water Level**
  Total Coliform with e. coli confirmation, chloride, sodium, bromide, barium, pH, total dissolved solids, MBAS (surfactants), conductivity, iron, manganese, ORP, Turbidity, and methane/ethane/propane.

- **Testing Package # 2 Recommendations- WV State Recommendations (Unconventional) Plus- T. Hardness, Magnesium, Selenium, Strontium, Zinc, Alkalinity, Nitrate, Total Suspended Solids, Oil & Grease, Turbidity, ORP, Bromide, and 21-VOCs (Volatile Organic Compounds) /MTBE and field measurements from Package #1.**

- **Testing Package # 3 Recommendations**

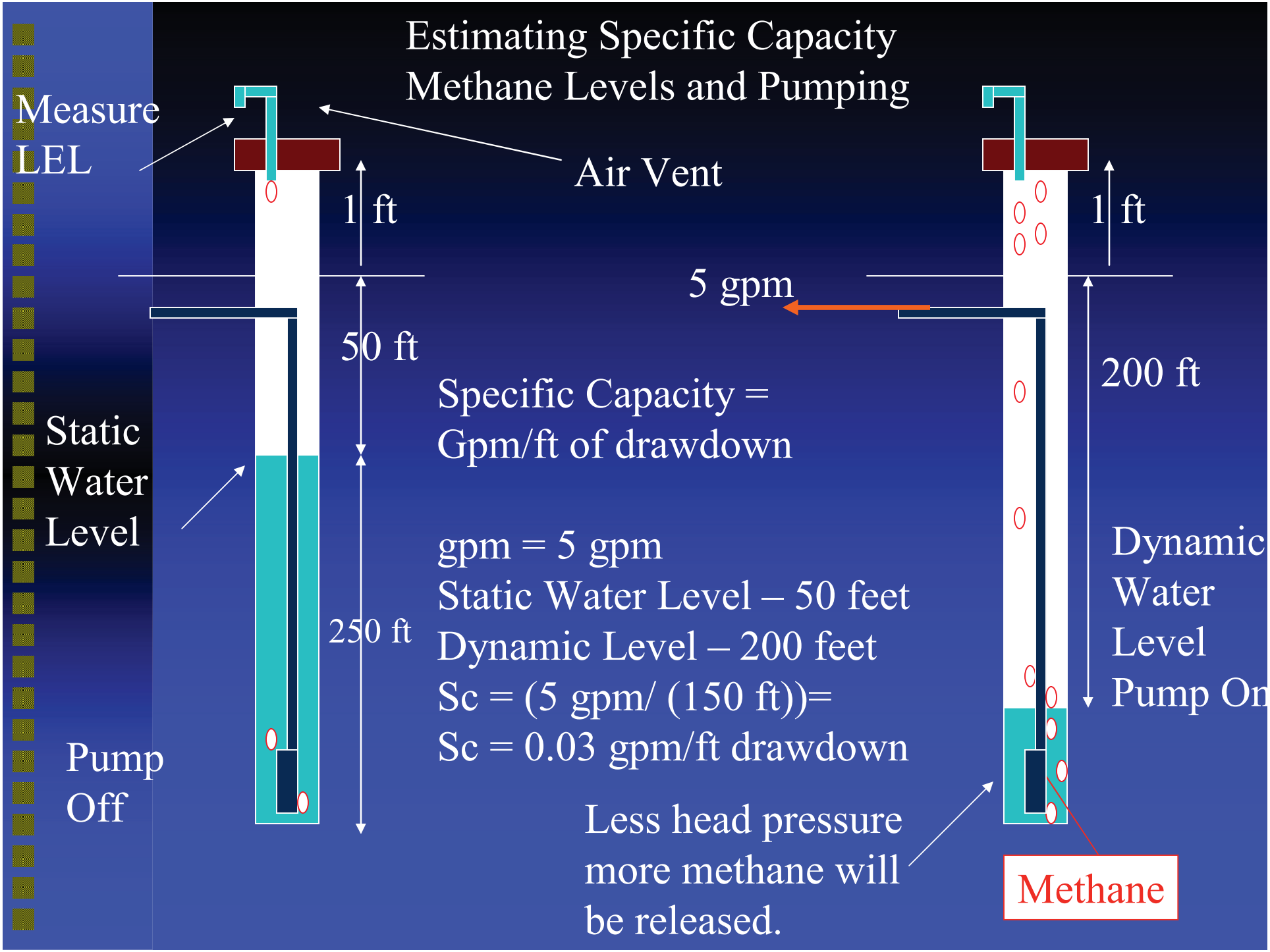
  Package #1 and # 2 - plus Potassium, Sulfide, Ammonia, Acidity, Nickel, Gross, Alpha/Beta Activity, Lead, Lithium, and Uranium.

It may be advisable to add Glycols, Radon in water, and other organic and inorganic parameters. Depending on surrounding land-use, use of geothermal wells, personal history, local geology, and past history for the area.

Remember - Methane Gas Level – Change over Time- Time with Highest Levels

- barometric pressure is low and soils are saturated;
- when snow cover is just beginning to melt;
- the ground is frozen or ice covered; or
- under long-term pumping conditions for the well when the well is experiencing the lowest dynamic water level and greatest drawdown.

http://www.water-research.net/methanegas.htm


Estimating Specific Capacity
Methane Levels and Pumping
Measure LEL
Air Vent
1 ft
1 ft
5 gpm
50 ft
200 ft
Static Water Level
Specific Capacity =
Gpm/ft of drawdown
gpm = 5 gpm
Static Water Level – 50 feet
Dynamic Level – 200 feet
Sc = (5 gpm/ (150 ft))=
Sc = 0.03 gpm/ft drawdown
250 ft
Dynamic Water Level Pump On
Pump Off
Less head pressure more methane will be released.
Methane

Need Help with Baseline Testing

- We Work With Multiple Certified Laboratories
- Conduct or Facilitate Baseline Sampling
- Provide Assistance in Reviewing Data
- Provide Assistance with Private Well Owner Education and Outreach
- Our Online Survey – Need Help – Just Ask
  http://www.surveymonkey.com/s/privatewell

Need Help – Call 570-335-1947
email – bfenviro@ptd.net
Visit – http://www.bfenvironmental.com

Getting The Waters Tested
Types of Water Testing

Step 3
Follow-up
Certified Testing

Step 3
Follow-up
Certified Testing

Step 1-Third-Party Sampler
and Certified Testing

Screening Tests
or Self-Monitoring

Step 2- Screening

Citizen Science
And Remote Monitoring

Baseline Testing – Just the Facts

Step 2- Level 2: Informational Water Testing – Test at Least Annually.

- Does Not Meet Definition of Certified Baseline Data and DOES Not Replace Certified Baseline Sampling.
- Conduct After Certified Baseline Testing is Done.
- Data would not hold up in Court as Proof of a change, but may be a cost effective screening tool.
- You can collect Sample.
- You submit the Sample to a Certified Laboratory
- The laboratory provides you the uncertified data.
- Significantly Cheaper than Follow-up Baseline Testing and You can Screen for More Parameters

Our Portal – http://www.check-water.com

Step 2- Level 3. Self-Screening

- Provides Certified Baseline Data – NO.
- Use After Baseline Testing is Completed.
- Helps to Track and Provide Supplementary Information – Yes
- Recommend This Testing along with maintaining a log of water conditions and drilling related activity.
- Self-Screening Tools – your eyes, ears, nose, mouth, and maybe some affordable sensors.

Note- We Recommend Home Screening Tests for pH, conductivity, and Oxidation Reduction Potential – We DO not Recommend Measuring Just a Total Dissolved Solids Value – Measure Conductivity !
Write Down the Results – Make Sure Your Are Trained to Use the Meter !

For Citizen Science

- Make sure to go through a short training program on the use of the equipment, calibration, reporting results, storing the data, and field safety.
- Make sure to follow safety protocols and work in teams.
- Do NOT Trespass that is why there are Zoom Lenses on Cameras.
- Do NOT Invade Private Space or Take Photos of Any Children.

Your Tools- Use a Log Book, Video, and Photos (date stamp)

- Eyes – look for signs of discoloration, sediment, chemical sheens, or gas.
- Nose – changes in odors
- Mouth – metallic taste, salty taste, bitter taste
- Ears – water hammer – Related to Gas
- Sensors – Conductivity, ORP, and pH pens
- Camera with Zoom Lens
- Video Documentation
- Write Down When You Calibrate the meter.

Need Help – Just Ask !
We Conduct Community Workshops !

Case Studies

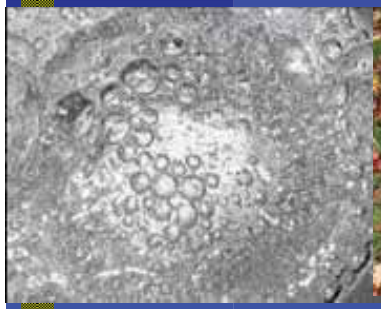
- We Do Cases Studies and We are Looking for Additional Cases Studies to Review.

What ? Where? How?

Problem Caused by Manganese, Slime Bacteria, and Iron Bacteria

Common Problems Associated with Natural Gas Development and Private Wells

- Dirty and Discolored Water – associated with the initial drilling of the well. Water has metallic taste.
- Increased Levels of iron, manganese, and aluminum and some other metals.
- Increased Levels of Dissolved Gases – Primarily Methane, but also ethane, propane, and radon.





Please Note – These are also Common Pre-existing Problems !

Working as a Community

- Getting the Community Educated
- Encouraging Well Owners to Get their water tested as best as they can afford and sharing this data (data only) with the Citizen Database.
- Working with Local Water Authorities- Watershed Groups Using Source Water Protection As a Guide
- Developing a Program to Fix Private Well – where baseline pre-drilling testing has identified a Problem – Remember we all live upstream.
- Permitting the gas company to conducting baseline testing and sharing this data (data only) as part of Community Meetings or Education Sessions – Develop a Local Database.
  - This should include wells, springs, surface ponds, and major waterways in the area.

Tracking Change

- Frac Focus – Chemical Registry - http://fracfocus.org (**Natural Gas Horizontal Well Control Act** – requires Submission of chemical data to Office of Oil and Gas with the WR-35 Reports on specific forms or a Frac Focus Format)
- Check Out Frac Tracker – YOUR Story Matters
  - http://www.fractracker.org/projects/usmap/
- Get Educated – Free Information on Water Quality and Oil / Natural Gas Development–
  - http://www.private-well-owner.org

Certificate of Completion

Training Event

Getting The Waters Tested The Black Shale Factor
West Virginia Approach

2 – hour PDH or 0.2 CEUS

Presented by

Mr. Brian Oram, PG

B.F. Environmental Consultants Inc

15 Hillcrest Drive

Dallas, PA 18612

More Online Training @

http://www.bfenvironmental.com

iCONSERVE PENNSYLVANIA

Our Latest Resource

Description of the following:

a. Citizen Database
b. Baseline Testing
c. Drinking Water Standards
d. Specific Water Quality Standards
e. Treatment Options
f. How to Shock Disinfect a Well
g. How to Properly Construct a Well
h. General Guidelines on Baseline Testing Parameters.

And More. cost$ 5.00

Other Resources at http://www.water-research.net

Document

- For permission – Contact Mr. Brian Oram, PG
- bfenviro@ptd.net
- 570- 335-1947

http://www.bfenvironmental.com

http://www.water-research.net

Presented by:

Mr. Brian Oram, Professional Geologist (PG),
Soil Scientist, Licensed Well Driller

B.F. Environmental Consultants Inc.

http://www.bfenvironmental.com

And

Water Research Center

http://www.water-research.net

http://www.bfenvironmental.com

http://www.water-research.net