Private Homeowner Drinking Water Issues
Luzerne County
Harveys Lake Presentation (Part II) - 2010

Presenter
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Center for Environmental Quality
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• Applied Research
• Community and Business Outreach Programs
Website: http://www.water-research.net
New Website – http://www.wilkes.edu/water

New Community Resource
Download a Free Copy or Link to a copy at http://www.wilkes.edu/water

Summary of Testing Results (2010)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tested</th>
<th>Standard or Guideline</th>
<th>% Exceeding</th>
<th>% Violated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coliforms</td>
<td>51</td>
<td>Above</td>
<td>28</td>
<td>56% (38 %&lt;200)</td>
</tr>
<tr>
<td>pH</td>
<td>51</td>
<td>&gt; 8.5</td>
<td>76 (&lt; 4.5)</td>
<td>1%</td>
</tr>
<tr>
<td>pH</td>
<td>51</td>
<td>&lt; 8.5</td>
<td>1 (&gt; 8.5)</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Nitrate</td>
<td>51</td>
<td>&lt; 10 mg/L</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Nitrate</td>
<td>51</td>
<td>Regional mean</td>
<td>4 (1-7 mg/L)</td>
<td>9%</td>
</tr>
<tr>
<td>Sulfate</td>
<td>51</td>
<td>&lt; 250 mg/L</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Copper</td>
<td>51</td>
<td>&lt; 1.5 mg/L</td>
<td>1</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Iron</td>
<td>51</td>
<td>&lt; 0.3 mg/L</td>
<td>1</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Chloride</td>
<td>51</td>
<td>&lt; 250 mg/L</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Sodium</td>
<td>51</td>
<td>&lt; 20 mg/L</td>
<td>24 (10-70 mg/L)</td>
<td>46% (2-100 mg/L)</td>
</tr>
<tr>
<td>Potassium</td>
<td>51</td>
<td>&lt; 15 mg/L</td>
<td>11 (2-20 mg/L)</td>
<td>56% (2-40 mg/L)</td>
</tr>
</tbody>
</table>

* EPA suggested limit for individuals on low sodium diet.
Water Treatment

- disinfection
- oxidation
- adsorption
- anion exchange
- cation exchange
- filtration
- pH adjustment
- demineralization

Match the pollutant with the correct process!

Recommendations
After the Water Has Been Tested

- Evaluate Existing Source
- Maintenance and Inspection of System
- Repair Existing Source
- Pollution Control Measures
- Treatment- POU, POE, or other

Explore all of them before taking action- FINAL ACTION!

Bacterial Issues, Odors, and Turbid Water: Inspect Well; Possibly Change Well Cap, Re grade Area, Divert Runoff

Disinfection
Shock Chlorination

May work for small numbers of coliform bacteria. Should be conducted after all well repairs, flooding, or problems with elevated bacterial counts. After shock disinfection – retesting for total coliform, standard plate count, and nuisance bacteria may be need.

Hydrogen Sulfide

- Hot water only?
  - Adjust water heater to a temperature of 140-160 °F for 6 to 24 hours and then flush
  - remove or replace rod in heater (Warranty Issues)

- Carbon Filtration- no bacterial problem
- Chlorination/ Contact Tank / Filtration
- Aeration- no bacterial problem
- Oxidizing filter- manganese greensand
- Shock disinfection may solve or temporarily solve this problem

Whole House Treatment
Point of Entry (POE)
Issues:
1) Chlorine Demand
2) Bacterial Levels
3) Other Water Quality problems like iron, sulfur, and odors
4) Alkalinity and pH of water may need adjustment

U-V Sterilizer
The Selection of UV Unit system depends on the following:

a) General Water Quality
b) Turbidity
c) Hardness
d) Iron and Manganese
e) Bacterial Levels
f) Source Water Type and Overall Water Quality?
g) Class A or Class B Unit?
http://www.nsf.org

Ozone

Acid (Corrosive Water) Control
Use this unit if existing pH is 6.0 or greater.
Target pH is 6.9 to 7.0 - use limestone.
Target pH is higher - use magnesia (magnesium oxide)

pH adjustment - Low pH
Chemical Pump
Storage Tank

Water Softener
Reduce Hardness, Iron, Manganese)
Do Not Remove All the Water Hardness!
Exchange: Sodium or Potassium for Ca, Mg, Fe, Mn, etc

Raw Water
Calcium & Magnesium
And other Multivalent cations

RESIN
(Sodium or Potassium)

Treated Water
(Sodium or Potassium)
Recharge with Brine

Calcium & Magnesium and other multivalent cations

Waste Water

RESIN (Calcium & Magnesium)

Brine (Sodium or Potassium)

Iron and Manganese Removal

• Form and concentration is important
  – Oxidized = visible, orange or black stain
  – Reduced = colorless

• Removal Methods
  – Water Softener
  – Chlorination / Filtration
  – Oxidizing Filter
  – Ozone

Nitrate Exchange Resin

Reaction Tank with Computerized Controller (adjustable)

Nitrate Exchange Resin

Nitrate Exchange Resin

Nitrate Exchange Resin

Reverse Osmosis

• force water through membrane
• removes many contaminants

Reverse Osmosis System

Pretreatment
1) Softener
2) Filtration
3) Disinfection
4) Fe / Mn Control

R/O Units

R/O Requires Storage

Size of Tank is a function of demand and water quality

Also, a percentage of the water is wasted. The recovery rate may be 20 to 30% (70 to 80% wasted)
Before You Buy Treatment Equipment
Get the Facts - Not the Sales Pitch

- Have your water tested by a reputable accredited, approved, and/or certified lab
  - Don’t rely on in-home water test results.
  - Don’t rely on free water tests.

- Consult unbiased water quality experts and get multiple quotes for a system.

- Explore all alternatives
  - Well rehabilitation, New source, Local Pollution Control, Maintenance

Tips for Buying Treatment Equipment

- Seek reputable companies that have been around
- Ask for customer references
- Research company history
- Beware of hard sale techniques (scare tactics)
- Ask about maintenance requirements
- Get a detailed warranty
- Look for NSF and WQA certifications
- EPA certification means nothing
- Get everything in writing!
- If it sounds too good - it is!

Marcellus Shale

Black Gold?

cellus Shale- Natural Gas Play
50 to 200 trillion cubic feet

Luzerne County
Shale may be 50 to 200 feet thick

This is why the term – Fairway is being used to describe the play.

Source: Cabot – Marcellus Shale Thickness Map
Marcellus Shale Drilling Site

Pads can be 5+ acres – but one pad can support drilling multiple horizontal wells.

Groundwater Moves - Slowly

feet per year

Datum

Sea Level

Background Testing and Baseline
(Work as a Community !)

- This requires chain-of-custody and the use of third party collectors.
- Sample collectors are either representatives of the certified laboratories and other professionals that are authorized by the laboratory to collect and deliver samples to the laboratory. You may want to use licensed professional that is approved by the laboratory.
- Field testing should be conducted at the time of sampling to determine the well is properly purged.
- Document static water levels, well production capacity, and spring flows.
- Pre Drilling Baseline – within 6 months of starting a production well.
- Post Drilling Testing – within 6 months of completion.
- Allow the Gas Companies to conduct the necessary baseline testing.

Some Recommendations on Baseline Testing – Residents over 1000 feet from Well Site

- Recommendations are for Residential / Private Wells that are outside 1000 feet of the well.
- Recommendations are for Private Wells that are not along a horizontal leg for the gas well.
- Different testing may be needed for springs and surface water.
- Pricing listed is based on survey of local certified laboratories, including Kirby Health Center, Seewald, Quantum, Lancaster, and NEEL.
Water Testing Recommendations

- Package #1 – Based on Penn State University Recommendations- Targeting Inorganic Natural High in Area and High in Flowback Water.
  - Parameters: total coliform, e. coli, chloride, sodium, barium, bromide, pH, iron, manganese, methane/ethane, and total dissolved solids.
  - Laboratory Cost – Approximately $300.00 - $375.00/sample.
  - Very inadequate – This is the minimum!
  - After this baseline evaluation — suggest adding nitrite and nitrate to this testing.

Water Testing Recommendations

- Package #2- Includes the Parameters in Package #1, plus (Based on PADEP Recommendations and Flowback Water Chemistry:
  - T. Hardness, Calcium, Magnesium, Selenium, Strontium, Alkalinity, Arsenic, Nitrate, Total Suspended Solids, Sulfate, add Nitrate
  - Oil & Grease, Surfactants, 21-VOCs, MTBE
  - Estimated Cost w/o Chain-of-Custody and Collection – Approximately $550.00 - $775.00/sample*.

*This is based on a survey of labs.

Water Testing Recommendations

- Package #3- Based on Flowback Water Chemistry, Regional Groundwater Normally Corrosive, and Elevated Levels of Radon in Air
  - Potassium, Sulfide, Ammonia, Acidity, Nickel, Gross Alpha / Beta, Lead, Uranium
  - Estimated Cost w/o Chain-of-Custody and Collection
    $850.00 - $1000.00 per sample*
  
*This is based on a survey of labs.

Water Testing Recommendations

- Package #4 – Comprehensive Testing
  1. Includes all drinking water parameters for a regulated source.
  2. Parameters that target Natural Gas, Constate Water, Brine Water, Flowback water that are not part of the Drinking Water Standards
  3. Additional Synthetic Organic Compounds
  4. This is not for the typical homeowner.
  
$1850.00 and Up*

*Based on a survey of certified labs.

Announcement

- Harvey’s Lake Environmental Advisory Council (EAC) is working on putting together information on baseline testing.
- Information will be posted on the Associations Website.
- http://www.harveyslakepa.us/eac.htm

General Geology

Horizontal Bedding

Use a Multiple Casing Approach
Geology of Appalachian Plateau Provinces
Learn More about Marcellus Shale

• PADEP Sites
  - http://www.dep.state.pa.us/dep/deputate/minres/oilgas/oilgas.htm

• Education Sites
  - http://extension.psu.edu/naturalgas
  - http://cce.cornell.edu/EnergyClimateChange/Pages/default.aspx

• Industry Sites
  - http://marcelluscoalition.org/

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