OVEC

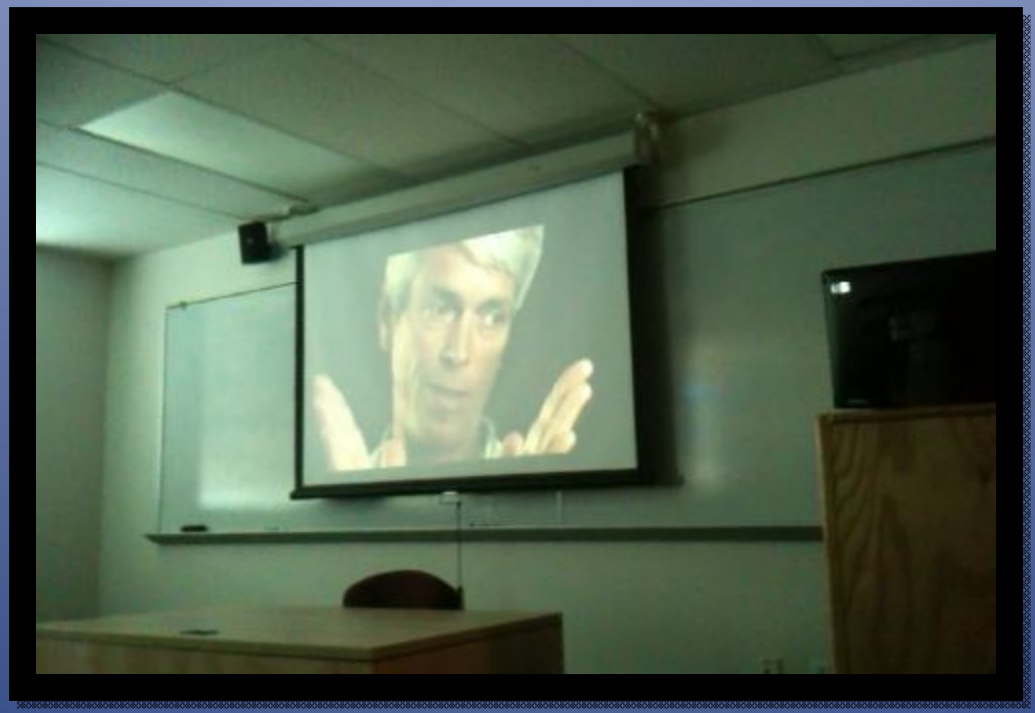
Celebrating 25 Years of Organized Voices and Empowered Communities

ohvec.org Huntington, WV

# Water and air quality concerns with the extraction of shale gas

Ben M. Stout III, Ph.D.
Department of Biology
Wheeling Jesuit University
316 Washington Ave.
Wheeling, WV 26003
bens@wju.edu

# Fract (L) break, or broken



# Fractwater Disposal Data

| Sample # | NW-MCF-042109-9 | N |
|---|---|---|
| Hauling Company | Deeter Farms | |
| Date Sampled | 4/21/2009 | |
| Time Sampled | 2:55 PM | |
| Site Name | Wyhe HH | |
| Well # | 37-121-23194 | |
| Type of Waste | | |
| Waste Source | Pit | |
| Volume in Truck. Gal. | 5000 | |
| Well Location. Co./St | Washington Co., PA | We |
| Well Owner/Producer | Range Resources | |
| Sample Color | Black | |
| Sample Odor | None | |
| Parameter, units | | |
| Arsenic, mg/l | 0.21 | |
| Barium, mg/l | 7.86 | |
| Boron, mg/l | 0.87 | |
| Iron, mg/l | 348 | |
| Magnesium, mg/l | 24.6 | |
| Potassium, mg/l | 1840 | |
| Selinium, mg/l | <0.2 | |
| Sodium, mg/l | 3500 | |
| Alkalinity, mg/l | <1 | |
| Total Dissolved Solids(TDS), mg/l | 16600 | |
| Flouride, mg/l | 340 | |
| Chloride, mg/l | 10900 | |
| Biochemical Oxygen Demand(BOD), mg/l | 3340 | |
| Chemical Oxygen Demand(COD), mg/l | 5240 | |
| Total Suspended Solids(TSS), mg/l | 810 | |
| Sulfate, mg/l | 229 | |
| Calcium, mg/l | 346 | |
| Bromide, mg/l | 45 | |
| TP-DRO, mg/l | 94.4 | |
| Benzene, ug/l | <12.9 | |
| Toulene, ug/l | <16.7 | |
| Ethylbenzene, ug/l | N/A | |
| m.p-Xylene, ug/l | N/A | |
| o-Xylene, ug/l | N/A | |
| Specific Conductance, umhovcm | 42100 | |
| Gross Alpha, pCI/l | 54.1 ± 24.9 | |
| Gross Beta, pCI/l | 1306 ± 244 | |
| Strontium, ug/l | 15800 | |
| Strontium-90, pCI/l | Minus 0.710 ± /1.47 | |
| Radium-226, pCI/l | 5.09 ±/ 2.83 | |
| Radium-228, pCI/l | Minus 0.0169 ± 1.08 | |
| Total Uranium, ug/l | 7.81 ± 0.336 | |
| Uranium-234, (Sludge Only) | | |
| Uranium-235, (Sludge Only) | | |
| Uranium-238, (Sludge Only) | | |
| pH, Standard units | 1.5 | |
| Temp. °C | 13 | |
| PID Reading, m.u. | 18 | |
| FiD Reading, m.u. | N/D | |
| Rad Meter Reading | Neg | |

**5,000 gallons**


**pH = 1.5**

# Fractwater Disposal Data

Fracwater disposal trucks entering liquid assets disposal sampled by WV DEP

| | *Liquid Assests Disposal Sampling Project April 21-22, 2009* | | | |
|---|---|---|---|---|
| Sample # | NW-MCF-042109-1 | NW-MCF-042109-2 | NW-MCF-042109-3 | NW-MCF-042109-4 |
| Hauling Company | Devoman | Devoman | Devoman | Devoman |
| Date Sampled | 4/21/2008 | 4/21/2009 | 4/21/2009 | 4/21/2009 |
| Time Sampled | 9:40 AM | 10:30 AM | 11:15 AM | 11:30 AM |
| Site Name | Whipkey #9 | Whipkey #9 | Whipkey #9 | Davbrook Comp Sta |
| Well # | 37-059-24820 | 37-059-24820 | 37-059-24820 | |
| Type of Waste | Frac | Frac | Frac | Other |
| Waste Source | Pit | Pit | Pit | Tank |
| Volume in Truck. Gal. | 4830 | 4830 | 4830 | 2160 |
| Well Location. Co./St | Greene Co. PA | Greene Co. PA | Greene Co. PA | Monongalia Co. WV |
| Well Owner/Producer | Atlas | Atlas | Atlas | Dominion |
| Sample Color | Tan | Clear | Clear | Black |
| Sample Odor | None | None | None | None |
| Parameter, units | | | | |
| Arsenic, mg/l | 0.29 | <0.2 | <0.2 | <0.2 |
| Barium, mg/l | 5.59 | 4.59 | 2.99 | 0.14 |
| Boron, mg/l | 44.4 | 35.6 | 38.2 | 58.6 |
| Iron, mg/l | 30.7 | 25.2 | 26.8 | 4.84 |
| Magnesium, mg/l | 488 | 453 | 485 | 5.4 |
| Potassium, mg/l | 836 | 665 | 710 | 11.7 |
| Selinium, mg/l | 0.2 | <0.2 | <0.2 | 0.76 |
| Sodium, mg/l | 17800 | 14100 | 14700 | 218 |
| Alkalinity, mg/l | 130 | 36.9 | 37.3 | 294 |
| Total Dissolved Solids(TDS), mg/l | 57800 | 53400 | 51500 | 1560 |
| Flouride, mg/l | 85 | 87.5 | 57.5 | 7.2 |
| Chloride, mg/l | 9300 | 31500 | 32000 | 135 |
| Biochemical Oxygen Demand(BOD), mg/l | 414 | 364 | 524 | 66400 |
| Chemical Oxygen Demand(COD), mg/l | 1420 | 914 | 947 | 290000 |
| Total Suspended Solids(TSS), mg/l | 210 | 170 | 213 | 239 |
| Sulfate, mg/l | 1350 | 799 | 807 | 129 |
| Calcium, mg/l | 4310 | 3750 | 4000 | 201 |
| Bromide, mg/l | 77.5 | 240 | 280 | 3.25 |
| TP-DRO, mg/l | 26.1 | 7.44 | 6.95 | 76.6 |
| Benzene, ug/l | <12.9 | <12.0 | <12.1 | 1310 |
| Toulene, ug/l | <16.7 | <16.7 | <16.8 | 271 |
| Ethylbenzene, ug/l | N/A | N/A | N/A | N/A |
| m.p-Xylene, ug/l | N/A | N/A | N/A | N/A |
| o-Xylene, ug/l | N/A | N/A | N/A | N/A |
| Specific Conductance, umhovcm | 88300 | 80400 | 80100 | 2390 |
| Gross Alpha, pCl/l | Minus 6.524 ±/106 | 17.5 ±/93.5 | 24.0 ±/56.6 | Minus 6.356 ±/30.3 |
| Gross Beta, pCl/l | 164 ±/140 | 201 ±/133 | 361 ±/99.7 | 21.5 ±/60.7 |
| Strontium, ug/l | 732000 | 709000 | 689000 | 7130 |
| Strontium-90, pCl/l | Minus 5.83 ±/3.46 | Minus 0.10 ±/3.88 | Minus 0.360 ±/4.67 | Minus 1.43 ±/1.98 |
| Radium-226, pCl/l | 8.30 ±/2.45 | 9.0 ±/2.45 | 1.49 ±/2.92 | 6.38 ±/3.10 |
| Radium-228, pCl/l | 73.5 ±/17.6 | 6.44 ±/2.73 | 1.45 ±/1.79 | 0.487 ±/ 0.483 |
| Total Uranium, ug/l | 1.09 ±/0.024 | 0.119 ±/0.004 | 0.117 ±/0.003 | 4.28 ±/0.523 |
| Uranium-234, (Sludge Only) | | | | |
| Uranium-235, (Sludge Only) | | | | |
| Uranium-238, (Sludge Only) | | | | |
| pH, Standard units | 6.63 | 5.95 | 5.98 | 7.93 |
| Temp. °C | 14.50 | N/D | 15.90 | 12.90 |
| PID Reading, m.u. | Neg | 0.10 | 0.10 | N/D |
| FiD Reading, m.u. | N/D | 3-4 | N/D | N/D |
| Rad Meter Reading | Neg | Neg | Neg | N/D |

# Water Well Data

| | | |
|---|---|---|
| Benzene | 666 | E |
| Toluene | 432 | E |
| Ethylbenzene | 132 | |

WELL

**Volatile Organics Summary**

| | |
|---|---|
| Sample Name | B Hall 1/31/10 |
| Misc Info | Headspace in vial |
| Date Acquired | 2/16/2010 12:25 |
| Data File Name | E021610-07.D |

*Results reported in ug/L (ppb)*

| Compound | Amount | | Compound | Amount | |
|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | < 1.0 | | Bromomethane | 4.22 | |
| 1,1,1-Trichloroethane | < 1.0 | | Carbon disulfide | < 1.0 | |
| 1,1,2,2-Tetrachloroethane | < 1.0 | | Carbon Tetrachloride | < 1.0 | |
| 1,1,2-Trichloroethane | < 1.0 | | Chlorobenzene | < 1.0 | |
| 1,1-Dichloroethane | < 1.0 | | Chloroethane | 1.5 | |
| 1,1-Dichloroethene | < 1.0 | | Chloroform | < 1.0 | |
| 1,1-Dichloropropene | < 1.0 | | Chloromethane | 13.5 | |
| 1,2,3-Trichlorobenzene | < 1.0 | | cis-1,2-Dichloroethene | < 1.0 | |
| 1,2,3-Trichloropropane | < 1.0 | | cis-1,3-Dichloropropene | < 1.0 | |
| 1,2,4-Trichlorobenzene | < 1.0 | | Dibromochloromethane | < 1.0 | |
| 1,2,4-Trimethylbenzene | 1.1 | | Dibromomethane | < 1.0 | |
| 1,2-Dibromo-3-chloropropane | < 2.0 | | Dichlorodifluoromethane | < 5.0 | |
| 1,2-Dibromoethane | < 1.0 | | Ethylbenzene | 132 | |
| 1,2-Dichlorobenzene | < 1.0 | | Hexachlorobutadiene | < 1.0 | |
| 1,2-Dichloroethane | < 1.0 | | Hexane | 1.0 | |
| 1,2-Dichloropropane | < 1.0 | | Isopropylbenzene | 4.4 | |
| 1,3,5-Trimethylbenzene | 4.1 | | m,p-Xylenes | 27.8 | |
| 1,3-Dichlorobenzene | < 1.0 | | Methylene Chloride | < 1.0 | |
| 1,3-Dichloropropene | < 1.0 | | Naphthalene | 103 | |
| 1,4-Dichlorobenzene | < 1.0 | | n-Butylbenzene | < 1.0 | |
| 2,2-Dichloropropane | < 1.0 | | n-Propylbenzene | 1.8 | |
| 2-Butanone | 7.91 | | o-Xylene | 9.3 | |
| 2-Chloroethylvinyl Ether | < 1.0 | | p-Isopropyltoluene | < 1.0 | |
| 2-Chlorotoluene | < 1.0 | | sec-Butylbenzene | < 1.0 | |
| 2-Hexanone | < 1.0 | | Styrene | 609 | E |
| 4-Chlorotoluene | < 1.0 | | tert-Butylbenzene | < 1.0 | |
| 4-Methyl-2-pentanone | < 2.0 | | Tetrachloroethene | < 1.0 | |
| Acetone | 50.4 | | Toluene | 432 | E |
| Acrylonitrile | 42.6 | | trans-1,2-Dichloroethene | < 1.0 | |
| Benzene | 666 | E | trans-1,3-Dichloropropene | < 1.0 | |
| Bromobenzene | < 1.0 | | Trichloroethene | < 1.0 | |
| Bromochloromethane | < 1.0 | | Trichlorofluoromethane | < 1.0 | |
| Bromodichloromethane | < 1.0 | | Vinyl Acetate | < 1.0 | |
| Bromoform | < 1.0 | | Vinyl Chloride | < 1.0 | |

| Surrogate Recoveries | % Recovery |
|---|---|
| Dibromofluoromethane | 95.1 |
| 1,4-Difluorobenzene | 101.9 |
| Toluene-d8 | 100.1 |
| 4-Bromofluorobenzene | 99.3 |

E = Estimated concentration; exceeds calibration curve range (up to 150 ug/L)

# Protect Yourself

**3 Simple Steps to Protect a Well or Spring from Marcellus Shale Fracking**

Dr. Ben Stout, Professor of Biology, Wheeling Jesuit University, bens@wju.edu

**Step 1: Test you water daily with a conductivity pen.**

-Conductivity is a measure of the ability of water to conduct an electrical current and changes in conductivity reflect changing water quality conditions.
-Check the conductivity of your household water supply once daily at relatively the same time (i.e. before making your morning coffee/tea/).
-Record the results in a notebook and watch for dramatic changes. Small change is expected on a daily and seasonal basis.

Conductivity pens can be used to monitor your well water. The cost anywhere from $80-150. Here are some links to some vendors of conductivity pens that we googled:
http://www.fondriest.com/products/extech_ec400.htm
http://www.forestry-suppliers.com/product_pages/View_Catalog_Page.asp?mi=3870
http://www.grainger.com/Grainger/EXTECH-TDSConductivitySalinity-Pen-1ZKY6

Measuring conductivity is the best way to detect spills and any potential contamination from produced water from the Marcellus Shale Formation. Typical conductivity recordings in regional streams range from 100-300µS/cm (microSiemens per centimeter). Your well water should be less than 500µS/cm. In a Greene County well, fracwater showed conductivity ranging from 81,000-84,000µS/cm in 3 different samples. Should your well become contaminated by brine water the change in conductivity should be dramatic.


**Step 2: Establish background water quality conditions of your well water.**

-Conductivity measures how much material is dissolved in the water; however, it does not identify what the 'material' specifically is.

-To determine the "material", you can order kits from an EPA certified lab. Fill the kit with your well water and send the samples back to the lab. The lab will send a detailed evaluation of your existing well water conditions.

-Keep your data in a safe place.

You can get water test kits from any water testing laboratory. For instance, I typically order kits, fill them up, and send them back to the National Center for Water Quality Research at Heidelberg University, http://www.heidelberg.edu/WQL . I recommend an ICP/MS metals scan ($80), nutrients ($20) and VOC's ($50-60). Do these tests repeatedly, once a month for 5 or 6 months to establish the background, or pre-drilling conditions of your well. Also test periodically during the nearby drilling of Marcellus Shale. Keep these results for your records.


**Step 3: Write it down, be vigilant and create a record for your well.**

-Record the characteristics of your water in your conductivity notebook. Include the color (i.e. clear, milky, brown), taste (i.e. no taste, bitter, salty), and odor (i.e. no odor, sulfur smell) of your water.

-Some chemicals that are toxic do not have any odor, taste or smell. There may be a period of time from when your well goes bad to when you notice any change, and consuming the water during that period could harm your health. This is why measuring the conductivity daily is important. If you notice a significant change in the conductivity of your water then stop consuming it immediately and send a sample to an EPA certified lab as in number 2.

# We live in an air quality non-attainment area

- West Virginia maintains a statewide network of monitoring stations. The network monitors the air quality. If the air quality fails to meet any of the NAAQS, the EPA designates the region as a nonattainment area.

- The DAQ is then required to develop a state implementation plan to achieve and maintain air quality standards in that area. State implementation plans must be approved by the EPA.

# Permit "application" to discharge regulated air pollutants

**AIR QUALITY PERMIT NOTICE**
Notice of Application

Notice is given that Chesapeake Appalachia, L.L.C. has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a New Source Review (45 CSR 13) construction permit for a natural gas production facility (Roy Ferrell Pad) located in Ohio County, West Virginia. From Interstate 70, take Exit 11 and travel south on CR 4/1 (Dallas Pike) for 2.16 miles to CR 39/6 (Wildlife Road) and turn left. Travel 0.37 miles to CR 39/2 (Laidley Run Road) and turn right. Travel 0.55 miles on 39/2 to well pad on the left.
The applicant estimates the potential to discharge the following Regulated Air Pollutants will be:
Nitrogen Oxides (NOx)

22.24 tons/yr
Carbon Monoxide (CO)

42.96 tons/yr
Volatile Organic Compounds (VOC)

Vice President, Operations
P.O. Box 18496
Oklahoma City, OK
73154-1496
Int. Feb. 13, 2012

**Horizontal Natural Gas Well Work Permit Application Notice By Publication**

**Notice is hereby given:** Pursuant to West Virginia Code Section 22-6A-10(e) prior to filing an application for a permit for a horizontal well the applicant shall publish in the county in which the well is located or is proposed to be located at Class II legal advertisement.

**Paper:** The Intelligencer, 1500 Main StreetWheeling, WV 26003-0100.

**Public Notice Date:** 02/13/2012 & 02/20/2012

The following applicant intends to apply for a horizontal natural gas well work permit which disturbs three acres or more of surface excluding pipelines, gathering lines and roads or utilizes more

Volatile Organic Compounds (VOC)

36.64 tons/yr
Particulate Matter (PM)
0.81 tons/yr
Sulfur Dioxide (SO2)

0.35 tons/yr
Acetaldehyde

0.08 tons/yr
Acrolein

0.08 tons/yr
Benzene

0.45 tons/yr
Ethylbenzene

0.28 tons/yr
Formaldehyde

0.42 tons/yr
Methanol

0.08 tons/yr
n-Hexane

2.14 tons/yr
Toluene

0.52 tons/yr
Xylenes

0.64 tons/yr
Methane

6.13 tons/yr
Carbon Dioxide

18,043.65 tons/yr
Nitrous Oxide

0.40 tons/yr
CO2 Equivalent

18,294.81 tons/yr

# Excerpts from recent Colorado study:

- Researchers from the Colorado School of Public Health have shown that air pollution caused by hydraulic fracturing or fracking may contribute to acute and chronic health problems for those living near natural gas drilling sites.

- The report, based on three years of monitoring, found a number of potentially toxic petroleum hydrocarbons in the air near the wells including benzene*, ethylbenzene, toluene and xylene. Other chemicals included heptane, octane and diethylbenzene but information on their toxicity is limited.

- Non-cancer health impacts from air emissions due to natural gas development is greater for residents living closer to wells. Ultimately due to a multitude of volatile organic compounds (VOCs), many of which have neurological and/or respiratory effects.

** Benzene has been identified by the Environmental Protection Agency as a known carcinogen.*


Story posted **2012.09.07 at 03:43 AM EDT**

NEAR SCIO, Oh. -- At least one person was injured when a fire broke out at a Harrison County drilling site early Friday morning.

The fire was reported at a drill site on Henderson Road outside of Scio.

One victim was transported by medical helicopter to a burn center in Akron.

It was not immediately clear what was inside the tanks that caught fire or what caused the fire. The Harrison County Sheriff's office confirmed that a vehicle also caught fire and that the State Fire Marshal's Office would likely be contacted.

Several agencies from Harrison County and the surrounding area responded to the site. As of 3:00 a.m., dispatchers said that fire crews were actively trying to put out the fire. Henderson Road was closed because of the fire.


**Update**

HARRISON COUNTY, Ohio — A worker was critically wounded with severe burns after a fire broke out at a Harrison County gas well site Friday.

Two gas tanks and one vehicle caught fire at the Chesapeake Energy site on Henderson Road near Scio around 2 a.m.

Sheriff Ron Myers said workers were transferring water from one tank to another using a gasoline-powered pump.

He said the incident is believed to be an accident and said something in the pump malfunctioned, causing it to throw a spark and start the fire.