Environmental & Public Health Impacts of Drilling for Natural Gas in the Marcellus Shale: What to Expect, How to Mediate

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Conventional and Non-conventional Natural Gas Extraction Methodologies

Schematic geology of natural gas resources
2008 – 50 TCF (trillion cubic feet) of estimated recoverable natural gas (Engelder and Lash, 2008)

November 2008 – Based on Chesapeake’s production, estimate of recoverable gas from the Marcellus Shale raised to more than 363 TCF (Esch, 2008). Current estimates vary from 116 – 516 tcf

U.S. uses about 23 TCF of natural gas per year (U.S. Energy Information Administration, 2010), so the Marcellus gas resource may be adequate to supply U.S.’s needs for roughly 15 years at current rates.
Marcellus drilling activity in PA to-date

Natural gas as we use it is almost entirely methane.

But underground, it can be associated with a variety of other compounds and gases as well as oil and water:

- Methane
- Propane
- Butane

Natural gas transported through pipelines must meet purity specifications to be allowed in, so most gas processing is done at the well site.
Drilling Rig in Rural Upshur County, WV

Potential Public Health Problems Associated with Intense Marcellus Shale Gas Production

- Excessive groundwater and surface water usage (Each fracked well uses 3-8 million gallons of water) (Hazen and Swayer, 2009)
- Exposure to fracing chemicals from leaks, spills, accidents, off gassing from frac-water pits
- Groundwater contamination from flowback and produced water - May contain toxic metals/elements, organic compounds (BETX), and elevated levels of radionuclides from the shale formation itself
- Inadequate treatment and inappropriate disposal of brine water into surface water – May add toxic anions and cations and increases TDS levels in drinking water supplies
- Inhalation exposure from volatile organic compounds in frac water, and air contaminants from diesel usage, compressor stations and gas drying facilities
- Methane gas in air and water and explosion potential
- Community and behavioral health impacts
Water Testing

Can be expensive

Establish baseline

Choose certified lab

(http://extension.psu.edu/water/resources/publications/water-pollutants/testing/thirdpartylabs.pdf)

• Many residents have approached the CHEC as well as those advocating for safer gas drilling asking for advice on well water and municipal water testing.

• Well water testing is very important, but caution needs to be exercised because it is an expensive undertaking.

• It is important to negotiate water testing with gas company if leasing and have a baseline test paid by the gas company before drilling.

• The use of a certified lab is very important. Be careful in choosing a lab.
Water Testing – What is Important

- Strontium
  - Exposure to stable or radioactive strontium occurs from ingesting contaminated food or drinking water or breathing contaminated air. In children, high levels of stable strontium can impair bone growth. High levels of radioactive strontium can cause anemia or cancer. (ATSDR)

- Barium
  - Gastrointestinal disturbances followed by hypokalemia, hypertension, and heart rhythm abnormalities are frequently reported following acute oral exposure to high doses of barium. (ATSDR)

- Manganese
  - The most common health problems in workers exposed to high levels of manganese involve the nervous system (ATSDR)

- Magnesium

- Organics

• Flow back and Produced Water elements:

  - Strontium
  - Barium
  - Manganese
  - Magnesium
  - Organics
Air Quality

- Gas drilling process, Compressors and Fracturing Ponds can emit volatile organic compounds (VOC) most notably BETX (benzene, ethalbenzene, toluene, xylene)
  - Benzene: known human carcinogen
  - Trimethylbenzene: chronic exposure to trimethyl benzene has caused nervousness, tension, anxiety, asthmatic bronchitis and blood changes in humans.
  - Xylene – neurotoxin
  - Carbon Disulfide – neurotoxin
  - Dimethyl Disulfide - neurotoxin

(Witter, 2008; EPA, 2009)
Fracking Pond Fire – Hopewell Township, PA – April 1, 2010
Fracking Pond Fire – Hopewell Township, PA – April 1, 2010
DEP to Meet With Drilling Companies to Discuss Ways to Prevent Dangerous Gas Migration Situations, Safeguard Homes, Water Supplies

HARRISBURG -- Department of Environmental Secretary John Hanger announced today that he has called a meeting of oil and gas companies with permits to drill in the Marcellus Shale to discuss what steps the industry must take to prevent gas migrating from wells and polluting Pennsylvania’s natural resources, which can create a public safety risk. The meeting will be held on May 13 in Harrisburg.

Impacts to Water from Gas Migration

Methane gas migration is not a new occurrence in PA, but has been associated with some Marcellus Shale gas extraction activities.
Except for location information, this dataset was provided by a request to the Pennsylvania Department of Environmental Protection for violation information from 2007* to the present. There were 9,370 violations in that span from 3,661 unique wells. Of that total, there were 2,075 Marcellus Shale violations from 592 wells. The data is current as of September 30, 2010.

* Electronic violations data are only available since 2007 from the PA DEP
**Government & Societal Challenges**

*Jurisdictional unevenness:* The energy development prompting population growth takes place in a political jurisdiction different from the one which bears the cost.

*New Comers vs. Old Timers:* Rapid growth frequently requires major new infrastructure expenditures to accommodate new residents and older residents may oppose subsidizing such expenditures under uniform taxation arrangements.

*Insufficient control of land use:* decisions about disposition of land as in federal coal or offshore leasing prevents the local government from using zoning or siting arrangements to ease adjustment.

*Severity of growth:* Sheer numbers of people entering to work, despite adequate housing, may be unassimilatable without significant declines in quality of public services and community life.
Volatile production patterns: The boom-bust cycle associated with energy development presents the local government with an uneven future path of public service demand.

Monopoly of information: the industry or regulatory agency exercises tremendous power over the pace of development and the amount of information that is available to planners; sometimes, an incentive to misinform exists.

Risk. The uncertainty surrounding the future of many energy activities raises the risk premium, often so high that the financial sector is unwilling to lend funds to or buy bonds of local governments.

(Jacquet, 2009)
Impacts on Community Safety and Roads in Wetzel County, West Virginia

Below: Trucks parked along blind bend in road. (Hughes, Wade, and Renaud 2010)

Above: Slip below drill site closes road to ambulance.

Above: Road Disintegration from Truck Traffic
Shale Gas Drilling Represents an Intersection of:

- Politics
- Economics
- Environmental preservation
- Science
- Policy
- Regulation
Concerns with Marcellus Shale Development

- A great deal of data and information but no way to access it with ease

- A need for many different stories to be told about the impacts of this shale play.

- Dissemination of information is critical because the industry has owned a good deal of the information market for a long time.

**Major Data Gaps!**
FracTracker

BLOG AND DATATOOL FOR TRACKING IMPACTS OF SHALE GAS EXTRACTION

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The Purpose

Manage Various Geo-located Datasets

- Environmental
- Environmental health
- Social & Behavioral Health
- Emergency preparedness
- Community & Public health
- Land use

Applications for All Shale Plays throughout U.S. & World
Crowdsourcing
Using the masses to make something better than you could build alone
Blog Features

Pages – About Us, Marcellus Resources, How FracTracker Works, DataTool, Events Calendar

Share It (Twitter, etc)

RSS Feeds – Most recent datasets from DataTool, CHEC documentary project videos, PA DEP News, Citizens’ Photos

Links

Search Button

Archive

Blog Followers & Contributors

Labels/Tags from Posts

The Blog – http://fractracker.org
Register

Splash page (screen shot right)

Free & automated using Rhiza tools (software developer)

Provide name and email address to encourage data accuracy

Can view datasets and take a tour without registering, but cannot upload or download data

DataTool – http://data.fractracker.org
My Home

Your profile – name, contact info, & a summary of your activity

Library of datasets uploaded, snapshots created

Everything is public.

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Explore

Dashboard / summary of site’s recent activity

Search / sort by datasets, snapshots, users, geographic area
My Home

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Search / sort by datasets, snapshots, users, geographic area
Upload
Accepts ESRI shape files, GeoTIFF raster imagery, KML, CSV, or GPX
Upload from URL or computer – Can be a new, part of a series, or replacement dataset
Provide metadata

View Dataset
Preview page (shown right) – Uploader info
Visualize data, comment or rate the dataset, or download the data

Metadata
Visualize = Map the data

This is why latitude and longitude are critical

Define what you want to show on the map

Adjust the screen to zoom in on an area

Learn more about an individual record

Save session for later or create a snapshot
Just like a snapshot you take with a camera, except this one can update automatically!

Provides information on how the snapshot is being used & what datasets were used to create it

Create a new visualization based on the snapshot

Download it

Or share it online (in pop up box to the right)
# Community Engagement – FracTracker Comments

## Suggestions

- Great platform to start this database work. Not sure how exactly the general public will be able to use it.
- Add a page on the blog that summarizes the datasets available on the datatool so that unfamiliar users can access categorized information.
- More data needs to be added for drilling occurring or planned outside of PA.
- Conduct user interface testing with various user groups.

## Praise

- My brain hurts in most computer situations but you made it possible for me to visit and use FracTracker in the future.
- Very excited that this tool helps to bring together diverse groups of stakeholders!
- I’m very interested to see how the tool evolves.
- The scope and successful application of technology of the FracTracker tool is fantastic. These is so much potential here.

References & Resources

Thank You

QUESTIONS?
CHEC@PITT.EDU OR CALL 412-624-9379

FracTracker Partners:
• Center for Healthy Environments and Communities, University of Pittsburgh graduate school of public health
• Foundation for Pennsylvania watersheds
• The Heinz Endowments
• Rhiza labs