Shale Gas Exploration and Production:

POTENTIAL HEALTH AND ENVIRONMENTAL IMPACTS

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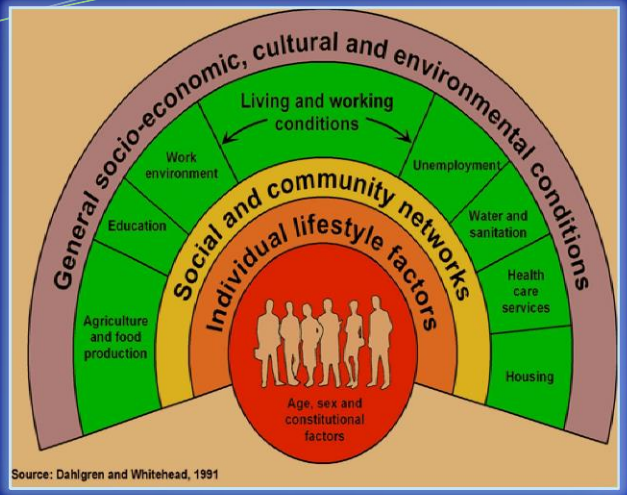
September 2013

Shale gas extraction and production using HVSWHFHL:

- Determinants of health—social and environmental stressors on health from gas drilling;
- Environmental stressors include air pollution, water contamination, chemical mix, radioactivity, waste, truck traffic, noise and light pollution.
- Lessons learned from the US
- Public health concerns, Health Impact Assessment and the New York medical community's advocacy



DETERMINANTS OF HEALTH

Who might be impacted?

People…

~ in areas mining silica

~ where gas drilling and fracking occur

~ near pipelines, power plants and storage facilities

~ who receive their water from gas drilling areas

~ who are downwind of gas producing or processing areas

~ whose regions receive gas drilling waste

~ Marcellus shale gas consumers

~ who are workers in the gas industry

~ whose health is already compromised, or who are vulnerable

…as well as animals, water , air and crops

AIR POLLUTION

- Witter R, et al, Battlement Mesa HIA 2011 http://www.garfield-county.com/environmental-health/battlement-mesa-health-impact-assessment-draft2.aspx
- McKenzie LM, et al, Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources 2012 http://www.ncbi.nlm.nih.gov/pubmed/22444058
- Colborn T, et al, An Exploratory Study of Air Quality near Natural Gas Operations 2012 http://www.endocrinedisruption.com/chemicals.air.php
- NOAA ozone study http://www.eenews.net/public/Landletter/2011/04/21/1

SOURCES OF AIR POLLUTANTS:

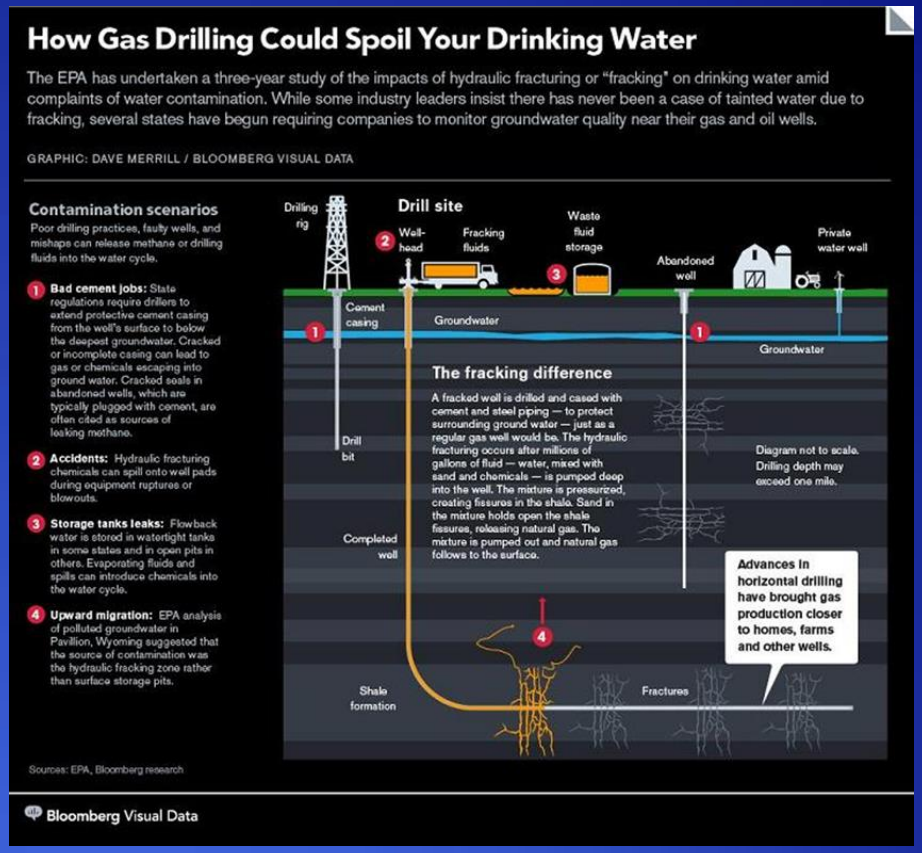
- Natural gas
  - CH_4 (potent GHG precursor)
  - BTEX - Benzene, toluene, ethylbenzene, and xylene
  - H_2S
- wells, compressor stations, storage tanks, pumps, pipes, processing plants, power plants, trucks
- Particulate matter
- Flaring
- VOCs
- Radon

NOAA

http://www.edf.org/sites/default/files/9235_Barnett_Shale_Report.pdf
http://www.epa.gov/airquality/oilandgas/pdfs/20120417presentation.pdf

WATER CONTAMINATION

- Methane migration—2011 Duke study http://www.biology.duke.edu/jackson/pnas2011.html
- Brine migration--2012 Duke and CalStatePolytech http://www.pnas.org/content/early/2012/07/03/1121181109.full.pdf
- Increased stray gas abundance in water wells near Marcellus shale gas wells—2013 Duke, U of Rochester, CalStatePolytech and Max Planck Institute http://www.pnas.org/content/110/28/11250.full.pdf
- Increased total dissolved solids and heavy metals in groundwater near Texas gas drilling sites--2013 Univ of Texas http://pubs.acs.org/doi/pdf/10.1021/es4011724
- Bamberger and Oswald—2012 New Solutions http://www.psehealthyenergy.org/Impacts_of_Gas_Drilling_on_Human_and_Animal_Health
- Amy Mall—NRDC 2011-12 http://switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html



http://www.damascuscitizensforsustainability.org/gas-drilling-can-spoil-your-water/ Used with permission of Bloomberg L.P. Copyright© 2013. All rights reserved

Yet, when the evidence points to contamination, EPA retreats under industry and political pressure http://www.propublica.org/article/epas-abandoned-wyoming-fracking-study-one-retreat-of-many

CHEMICAL MIX

~is considered proprietary

~includes known or suspected carcinogens, mutagens, endocrine disruptors, neurotoxins, hazardous air pollutants

~many of the chemicals in these products have effects at low doses, and children and pregnant women should not be exposed to some at all.

Dr Theo Colborn describes the chemicals associated with gas drilling operations

http://www.endocrinedisruption.com/files/GasManuscriptPreprintforweb12-5-11.pdf

http://www.shreveporttimes.com/apps/pbcs.dll/gallery?Avis=D9&Dato=20090429&Kategori=NEWS&Lopenr=904290802&Ref=PH&Profile=1060

Some of the chemicals used in gas drilling and hydraulic fracturing that are toxic to human health:

- Benzene (known carcinogen)
- Ethylbenzene
- Toluene (causes miscarriages, placenta previa)
- Xylene
- Diesel (recently classified by WHO as a carcinogen)
- Naphthalene (neurotoxin; carcinogen)
- Polynuclear aromatic hydrocarbons (PAHS) (carcinogens)
- Formaldehyde (known carcinogen)
- 2-Butoxyethanol (2BE) (known carcinogen); active component of Corexit which was used as a dispersant in the Exxon Valdez and BP Gulf disasters

http://www.atsdr.cdc.gov/ToxProfiles/tp118-c2.pdf

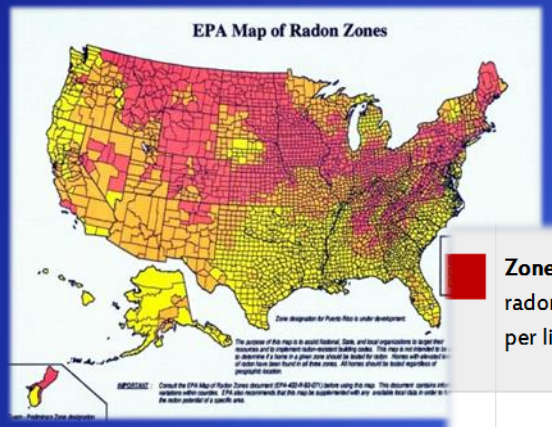
WASTE

- hazardous with current disposal methods
  http://www.shalegas.energy.gov/resources/060211_earthworks_petroleumexemptions.pdf and http://www.dcbureau.org/201308148881/natural-resources-news-service/new-york-imports-pennsylvanias-radioactive-fracking-waste-despite-falsified-water-tests.html#more-8881
- waste contains radioactive elements, brine and gases
  http://www.grassrootsinfo.org/pdf/radioactivewaste.pdf and http://www.grassrootsinfo.org/pdf/whitereport.pdf
- exempt from federal oversight http://www.epa.gov/osw/nonhaz/industrial/special/oil/oil-gas.pdf
- disposal in underground injection wells can, and has caused earthquakes *Katie M. Keranen, Heather M. Savage, and Geoffrey A. Abers et al., "Potentially Induced Earthquakes in Oklahoma, USA: Links between Wastewater Injection and the 2011 Mw 5.7 Earthquake Sequence," Geology, vol. 41, no. 3 (March 26, 2013)* http://geology.gsapubs.org/content/early/2013/03/26/G34045.1.abstract http://www.ldeo.columbia.edu/news-events/wastewater-injection-spurred-biggest-earthquake-yet-says-study http://stateimpact.npr.org/texas/tag/earthquake/

http://www.michiganradio.org/post/questions-linger-after-company-spreads-toxic-chemicals-northern-michigan-roads

RADIATION

- recommendations from the International Atomic Energy Agency (IAEA) http://www-pub.iaea.org/MTCD/publications/PDF/TCS-40_web.pdf
- federal exemption http://www.epa.gov/osw/nonhaz/industrial/special/oil/oil-gas.pdf
- radon and gas extraction http://www.youtube.com/playlist?list=PL5ZIvUpU2rIFyetf942AHLVpq-w5YMfda



	Zone 1 counties have a predicted average indoor radon screening level greater than 4 pCi/L (picocuries per liter) **(red zones)**	**Highest Potential**
	Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L**(orange zones)**	**Moderate Potential**
	Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L **(yellow zones)**	Low potential

SILICOSIS

http://www.iatp.org/documents/the-economic-benefits-and-costs-of-frac-sand-mining-in-west-central-wisconsin

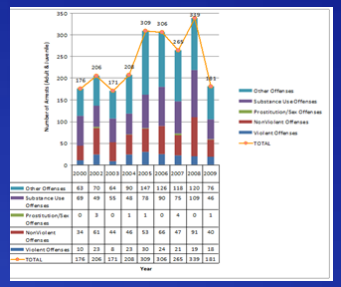
http://wvaccidentlawyer.files.wordpress.com/2012/09/silicosis1.jpg

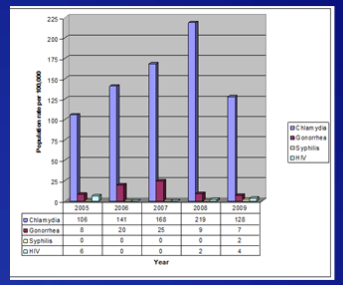
http://www.osha.gov/dts/hazardalerts/hydraulic_frac_hazard_alert.html

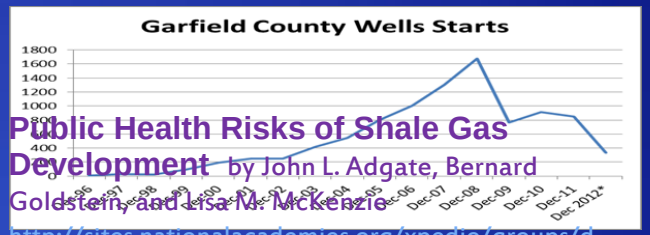
http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/pulmonary/occupational-lung-disease/images/Occupationalfig4_thumb.jpg

COMMUNITY IMPACTS

- traffic and road safety
- worker safety, accidents
- housing, community character, schools
- crime, sexually transmitted infections and substance abuse
- economic issues such as employment, value of home
- health infrastructure including availability, insurance, cost
- justice concerns such as vulnerable populations, equality
- cumulative effects of multiple stressors







Public Health Risks of Shale Gas Development by John L. Adgate, Bernard Goldstein, and Lisa M. McKenzie

http://sites.nationalacademies.org/xpedio/groups/dbassesite/documents/webpage/dbasse_083235.pdf

- loss of viewshed, foodshed and watershed; surface disturbance for one well pad is 3-5 acres

http://pubs.cas.psu.edu/freepubs/pdfs/ee0020.pdf

What are medical professionals observing in gas drilling areas?

From Dr David Brown's presentation at the National Academy of Sciences workshop—
Review of SWPA_EHP experience
http://sites.nationalacademies.org/xpedio/groups/dbassesite/documents/webpage/dbasse_083486.pdf

Potential Airborne Hazards from Natural Gas Extraction

- Barium
- Arsenic
- VOCs
- PAHs
- BTEX
- Methylene chloride
- Glycols
- Fine particulate matter
- Carbon monoxide
- Silica dust
- Radium
- Acetaldehyde/Formaldehyde

Potential Waterborne Hazards from Natural Gas Extraction

- All the chemicals listed above, plus
- Biocides
- Microbial contamination
- Components of drilling solvents
- Lithium

The necessary criteria for designating a symptom as attributable to gas extraction activities included:

- Temporal relationship
- Plausible exposure
- Absence of a more likely explanation

Health Symptoms Temporally Associated with Gas Drilling Activities

Most common symptoms experienced by individuals and families evaluated by SWPA-EHP:

Symptom/% of Individuals

Skin rash or irritation/48%
Nausea or vomiting/45%
Abdominal pain/38%
Breathing difficulties or cough/41%
Nosebleeds/21%

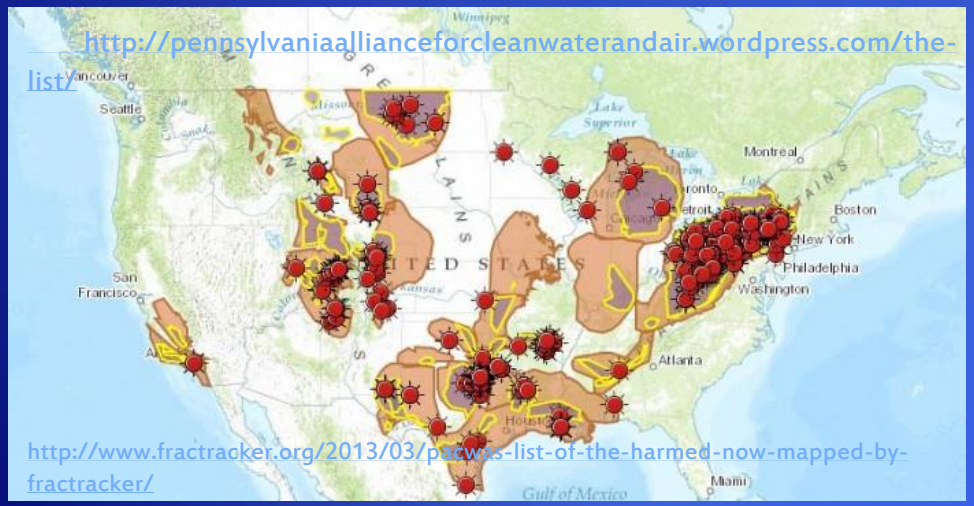
Other common complaints from SWPA-EHP clients population include:

- Anxiety/Stress
- Nervous system problems including headaches and dizziness
- Eye irritation
- Throat irritation

There is no public health agency in the United States that is routinely seeking and compiling information about people who have been adversely impacted by shale gas development…not on the local, or county, or state, or federal level.

http://blog.shaleshockmedia.org/wp-content/uploads/2013/04/dr-gag-300x177.jpg

Jenny Lisak's **List of the Harmed** has over 1500 names



http://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/

http://www.fractracker.org/2013/03/pa-was-list-of-the-harmed-now-mapped-by-fractracker/

Instead…

http://climate-connections.org/2013/08/02/range-resources-attorney-seeks-gag-order-on-7-and-10-year-old-in-pittsburgh-area-shale-gas-case/

non-disclosure agreements are common, and prevent important information-sharing

Work of health professionals in the US on shale gas development

PSE

Continuing Medical Education Series on Shale Gas Development

Physicians, Scientists & Engineers for Healthy Energy

www.PSEhealthyenergy.org

Concerned Health Professionals of NY

Dr Sandra Steingraber has been an outspoken advocate for health rights, and co-founded www.concernedhealthny.org

Summary Report, Human Health Risks and Exposure Pathways of Proposed Horizontal Hydrofracking in New York State: http://www.grassrootsinfo.org/summaryrepo GRASSROOTS

The Southwest Pennsylvania Environmental Health Project http://www.environmentalhealthproject.org has published a *Medical Toolkit* for medical professionals.

SWPA-EHP

Drs Michelle Bamberger and Robert Oswald are the guest editors of an online journal *New Solutions: A Journal of Environmental and Occupational Health Policy*

http://www.psehealthyenergy.org/Impacts_of_Gas_Drilling_on_Human_and_Animal_Health

Wilma Subra and Nadia Steinzor of Earthworks Oil and Gas Accountability Project conducted and published a survey of common health complaints Gas Patch Roulette: Full Report

EARTHWORKS

Drs Adgate, Witter and Wernham were the lead authors on the first Health Impact Assessments on gas drilling http://www.garfield-county.com/environmental-health/battlement-mesa-health-impact-assessment-draft2.aspx http://www.who.int/hia/conference/wernham.pdf and http://www.hiaguide.org/hia/national-petroleum-reserve-alaska-oil-development-plan

TEDX

The Endocrine Disruption Exchange

Dr Theo Colborn has been documenting health impacts of chemicals and air toxins in Colorado

These New York State medical organizations have asked for a moratorium so that scientific studies could be done prior to the decision on gas drilling

- **American Academy of Pediatrics, District II, New York State**
- **Mt. Sinai Children's Environmental Health Center**
- **NYS Conference of Environmental Health Directors**
- **Bassett Healthcare Network Board of Trustees and the Medical Staff**
- **THE MEDICAL SOCIETIES *of the NY Counties of* ONEIDA, HERKIMER, BROOME, MADISON, OTSEGO, OSWEGO, CAYUGA, CHENANGO, ONONDAGA, TOMPKINS**
- **Medical Society of the State of New York**
- **Physicians for Social Responsibility**
- **Concerned Health Professionals of NY**

There is a process which brings public health to the table and which can inform land use decisions and should be used **prior to the development of regulations and before permitting**. It is particularly important in the case of gas exploration and production.
In New York the government agency reviewing this issue has not yet ordered such a study, despite requests from numerous medical organizations.

HEALTH IMPACT ASSESSMENT

"HIA is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects."

"Improving Health in the United States: The Role of Health Impact Assessment"
http://www.nap.edu/catalog.php?record_id=13229

In New York, the medical community recommends:

- Educate www.concernedhealthny.org and www.psehealthyenergy.org/courses and advocate for patients www.environmentalhealthproject.org/ and http://www.aoec.org/pehsu.htm
- Reverse all the exemptions from federal environmental laws
- Provide information and opportunity for informed consent
- Enact laws which protect people, especially the most vulnerable
- Prohibit non-disclosure agreements
- Provide funding for much needed research
- Use the Health Impact Assessment as a process to inform decision-makers and the public prior to the decision
- Prohibit drilling while studies are being done and evaluated
- Focus on renewables
- Follow the Precautionary Principle
- Only after we gain a clear understanding of why people become ill near gas drilling operations can a decision be made whether to permit this activity


Thank you
Source: http://passaicnews.wordpress.com/