

Here are the topics and speakers.

**1. Impacts of Unconventional Shale Gas Development on Municipal Wastewater Treatment Plant, Great Bend, PA**

*from Bret Jennings, Director, Hallstead Great Bend Joint Sewer Authority, Presenter – Jeff Zimmerman*

**2. Impacts of Unconventional Shale Gas Development on Municipal Water Supply Authority, Beaver Falls, PA**

*from James Riggio, Beaver Falls Water Authority manager, Presenter – Buck Morehead*

**3. PADEP Determination Letters Finding Impacts of Unconventional Shale Gas Development on Groundwater and Drinking Water Supply**

*from PA DEP, Presenter – Shirley Masuo*

**4. Geologic Methane Leakage in Wyalusing PA Area and Well Failure Rates Reported by PADEP**

*Presenter – Barbara Arrindell*

**5. Global Warming Effects of Unconventional Shale Gas Development**

*from Professor Ingraffea, Presenter – Mav Moorhead*

**6. Flowback and Produced Water Disposal by Underground Injection and Earthquakes**

*Presenter – Joe Levine*

**7. Update on Health Impacts of Unconventional Shale Gas Development**

*Presenter – Dr Larysa Dryszka*

**8. Biodiversity Impacts of Unconventional Shale Gas Development**

*Presenter – David Burg*

**9. Adverse Economic Effects of Unconventional Shale Gas Development**

*from Elizabeth Radow, Presenter – Wendy Robinson*

**10. Summary and Policy Conclusions**

*Presenter – Al Appleton*

September 10, 2013

Jeff Zimmerman  
Zimmerman & Associates  
13508 Maidstone Lane  
Potomac, MD 20854

RE: Beaver Falls Municipal Authority

Atty. Zimmerman,

The Beaver Falls Municipal Authority (BFMA) is public drinking water system that pulls water from the Beaver River in Beaver Falls, PA, which is formed by the confluence of the Mahoning and Shenango Rivers near New Castle, PA. BFMA began experiencing elevated Brominated levels in 2009. These elevated levels caused BFMA to exceed the EPA's Maximum Contaminant Level (MCL) for Total Trihalomethanes (TTHM'S) for the first 3 quarters of 2010. The MCL for TTHM's is a running annual average (RAA) of .08mg/l, which is comprised of an average of the four most recent quarterly samples. The RAA for the first quarter of 2010 was .087mg/l, for the second quarter of 2010 was .097mg/l, and for the third quarter of 2010 was .0857mg/l. Each of these occurrences required BFMA to publically notify all of our 18,000 customers that we were in violation of an EPA drinking water standard. Beginning in September 2010 BFMA began using chloramines as its primary disinfectant over chlorine which had been used by BFMA for over 50 years. The main reason for this change was that chloramines produce lower levels of TTHM's. This change will also enable BFMA reduce TTHM levels in our drinking water and remain in compliance with EPA's drinking water standards. BFMA expended over \$25,000 in capital for this conversion. Chloramine disinfection has been used for over 80

years but can cause problems to people on dialysis machines if not removed prior to dialysis. Chloramines may also be toxic to fish.

Over the past 4 years there have been at least 3 instances where individuals or companies have been prosecuted for illegally dumping frack water into the Mahoning, Shenango, or Beaver River. Unfortunately in every instance BFMA was not notified until a few days after each episode and are unsure if any of the frack water made it to our intake. While it has been documented many places that frack water has elevated levels of brominated disinfection byproducts, which are precursors to TTHM formation no correlation was traced back to any legal or illegal discharges up stream of our intake.

If you have any questions, please feel free to contact me at (724) 846-2400 Extension 231.

Sincerely,

James Riggio  
General Manager

Damascus Citizens for Sustainability would like to present the DRBC Commissioners and staff over 100 Determination Letters from the Pennsylvania Department of Environmental Protection, sent to home and business owners whose water was affected by nearby gas well drilling. As there is both a time frame after the well is completed and a distance requirement that the home or business has to be from the well to have a challengeable presumption of responsibility by the gas drilling company apply, all of these cases are in both required limits. These limits were changed recently from 6 months to one year and from 1,000 feet to 2,500 feet but the older cases will not be revisited. There would be many more receiving a positive determination of impact with even this small widening of the two requirements. A positive determination means that the DEP has to do additional investigation and drilling company has to replace the water supply in some fashion satisfactory to the DEP.

The letters are from the years 2008 through 2012. They were obtained via a Right To Know request and a lawsuit filed by the Scranton Times, taking a year and a half to acquire them. They show that the Department's investigations indicate that the home or business owners' water supplies were impacted by gas well drilling with changes in either water quantity or quality based on testing done before drilling and after. The details in the letters show what these changes are including diminished quantity and increases in minerals, salts, changes in pH and clarity of the water and gasses, often methane, moving with the water.

In addition to these letters to individual home and business owners, there are on the supplied disc about 30 investigations and consent orders covering wide areas, whole neighborhoods with multiple homes and businesses. One of these was spoken of by my colleague and has 6 maps of impacted areas each covering about 24 square miles - that's number 161 on the disc - areas where there we know the damage continues.

These letters are, at long last, proof that the hydraulic fracturing horizontal drilling process DOES impact water supplies and is doing so in Pennsylvania and that therefore, drilling should not be allowed in the Delaware River Basin.

## **Geologic Methane Leakage in Wyalusing PA Area and Well Failure Rates Reported by PADEP** Presenter – Barbara Arrindell

First let's start with well failure rates - these are based on Pennsylvania DEP reports of wells drilled, violations and failures as assembled by Prof. Ingraffea of Cornell University.

**1,609 wells drilled in 2010. 97 well failures. 6% rate of failure.**

**1,972 wells drilled in 2011. 140 well failures. 7.1% rate of failure.**

**1,346 wells drilled in 2012 120 well failures. 8.9% rate of failure.**

### **Consistent with previous industry data, and not improving**

I would like to stress that these mistakes, errors, failures result in permanent damage that impacts real places and real communities and real people and their lives and hopes and families...to say nothing of their property values. And these are only the initial failures - as the drilling proceeds, though there are nine listed types of violations possible, for many more wells, "The inspection reports indicate that many failed wells were not issued violations." according to Dr. Ingraffea's research. To pretend that allowing drilling in the Delaware Basin would produce different results is foolish.

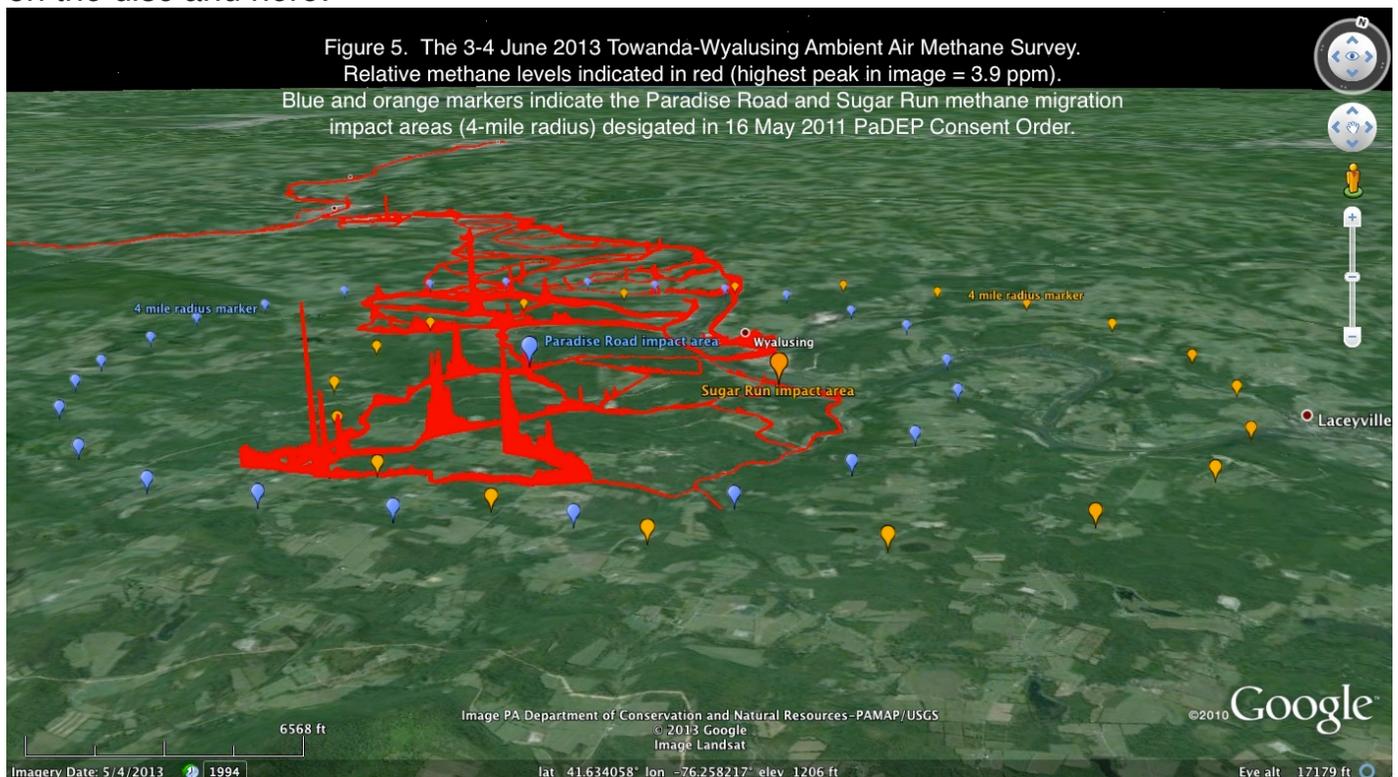
So now to look at one of those real places certified as an impacted area by PA DEP. This is along the Susquehanna River in Bradford County where PA DEP fined Chesapeake Appalachia, LLC \$900,000. for causing "stray gas" conditions, impacting the area and contaminating water supplies. DCS sent GasSafetyUSA with a Picarro CRDS machine to record the methane levels from public roads where there were reports of bubbling in the Susquehanna River and in ponds, puddles and in residents drinking water sources. Though it is harder to record methane any distance away from its source we found elevated methane levels, as shown in figure which combines the roads covered in the June GasSafety run with two of the impact area maps in the "Consent Order" of May 16, 2011. Blue and orange markers indicate the Paradise Road and Sugar Run methane migration impact areas(4 mile radius each) mapped in that Consent Order and show about double the surrounding local methane baseline levels. There is definitely an ongoing methane leakage situation here and contamination of drinking water sources that has continued since September, 2010 through the GasSafety methane survey in June, 2013.

**IN OTHER WORDS THE AREA IS STILL IMPACTED AND THE WATER SOURCES ARE STILL CONTAMINATED FROM DRILLING.**

The Conclusion from the September, 2013, GasSafety Wyalusing Report “Methane from any source rapidly diffuses and rises in the air. Consequently, detection of possible methane sources from any distance away requires extremely sensitive measurement capabilities. The GSI survey approach takes advantage of extremely sensitive measurement instrumentation to detect small increases in ambient air methane levels as an indication of probable methane emissions sources in a given area. Based on the data collected using that equipment, we conclude that the Towanda-Wyalusing area is probably substantially impacted by methane emissions from shale gas wells both within and beyond the survey area. The coincidence of two DEP methane migration impact areas, Paradise Road and Sugar Run, and the most marked elevated ambient air methane levels suggests there are still gas control problems associated with the shale gas wells there, as well as in another documented impact area in Leroy Township also cursorily measured following the main survey. A rapid water test in the Leroy area confirmed the water in that area is still contaminated with methane. These survey results suggest measures taken by gas well operators with regard to methane migration problems that have occurred in these three areas have likely been only partially effective.”

IN OTHER WORDS THE AREA IS STILL IMPACTED AND THE WATER SOURCES ARE STILL CONTAMINATED FROM DRILLING.

The figure is from the GasSafety Report on these Wyalusing area measurements - found on the disc and here:



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"Stray Gas" Definition • A gaseous material that is from an undetermined source that is located in area that may become hazardous. • Hazardous conditions can be flammable, toxic, or oxygen reducing that could cause suffocation. [http://pa.water.usgs.gov/projects/energy/stray\\_gas/presentations/3\\_840\\_Graeser.pdf](http://pa.water.usgs.gov/projects/energy/stray_gas/presentations/3_840_Graeser.pdf)  
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\$900,000. fine - <http://www.businessweek.com/ap/financialnews/D9N9C7981.htm>  
Consent order referenced here is #161 in this Determination letters folder on the disc and at this link: <https://www.dropbox.com/s/ndgx7fe2hg8f2dg/161%20Consent%20Agreem%20Susquehanna%20River.pdf>

CRDS [http://www.picarro.com/technology/cavity\\_ring\\_down\\_spectroscopy](http://www.picarro.com/technology/cavity_ring_down_spectroscopy)

<http://www.damascuscitizensforsustainability.org/wp-content/uploads/2012/11/PSECementFailureCausesRateAnalysisIngraffea.pdf>

Table 1. Violation Codes Used to Identify Wells with Violations for Figure 7.

78.73A - Operator shall prevent gas and other fluids from lower formations from entering fresh groundwater.

78.81D2 - Failure to case and cement properly through storage reservoir or storage horizon

78.83A - Diameter of bore hole not 1 inch greater than casing/casing collar diameter

78.73B - Excessive casing seat pressure

78.83GRNDWTR - Improper casing to protect fresh groundwater

78.83COALCSG - Improper coal protective casing and cementing procedures

78.85 - Inadequate, insufficient, and/or improperly installed cement

78.86 - Failure to report defective, insufficient, or improperly cemented casing

207B - Failure to case and cement to prevent migrations into fresh groundwater

## HEALTH IMPACTS OF SHALE GAS EXTRACTION AND PRODUCTION

Larysa Dyrszka MD

Completed health studies, both in the peer-reviewed literature and those initiated or reported by grassroots groups and the press, indicate that significant negative health impacts occur near gas exploration and production activities. Emerging health studies, including the Geisinger and University of Pennsylvania studies will give a clearer picture over the next few years. Most importantly, there are many people who have already been impacted in states where gas extraction using high volume hydraulic fracturing is permitted. We must carefully study these cases and determine pathways of exposure and contamination – scientific information that is fundamental to making informed decisions about the process. As we review the studies already completed, and speak with impacted people, we are increasingly aware that there are stressors on health that cannot be mitigated.

For these reasons, explained in more detail below, a moratorium on permitting gas extraction using high volume hydraulic fracturing must continue. Only after we gain a clear understanding of why people become ill near gas development activities can a decision be made whether to permit this activity, or ban it altogether. We cannot gamble with people's health.

Over the past couple of years, the medical community in NY State has repeatedly called on our Governor to stop the process which would lead to permitting and pay heed to the science. In 2010 the American Academy of Pediatrics of NY State (AAPNYS) issued a Memo of Support for the moratorium tied to the EPA study. The AAPNYS, together with other medical organizations in NY—the American Academy of Family Physicians of NYS, the NYS chapter of the American Nurses Association, the Medical Society of the State of NY, and others—asked for additional health studies, including a comprehensive, inclusive and transparent Health Impact Assessment (HIA) to be undertaken in NY State where gas drilling has not yet begun.

The Governor recently stated that he is taking the science under advisement. And that's a good thing because science is confirming that gas drilling is too risky to human health to go forward as it's currently done. I hope that the Governor's representative on the Delaware River Basin Commission moves with the same caution.

Recent climate events have also served to convince our lawmakers that climate change is real. Recently, a paper was published whose authors from Stanford, Cornell and Physicians, Scientists and Engineers for Healthy Energy demonstrate how NY State can be totally fueled by renewables by 2030. The same could be true for the other states of the DRBC. <http://www.psehealthyenergy.org/site/view/1083>

Three major studies, which will shed light on health, are underway:

--the Geisinger study will use electronic records, which are already in place, to track certain diseases;  
<http://pipeline.post-gazette.com/news/archives/25056-1-million-grant-for-pa-gas-drilling-health-study>  
<http://poststar.com/news/local/fb6c60aa-88de-11e2-8a9f-001a4bcf887a.html>

*The Geisinger study is a health outcomes design and plans to measure exposures through the use of geocoding;*

--the U Penn study

<http://green.blogs.nytimes.com/2013/01/21/taking-a-harder-look-at-fracking-and-health/>

(This description of the UPenn study is from a personal communication):

Study [1] 'Field Survey of Health Perception and Complaints of PA Residents in the Marcellus Shale' led by Dr. Pouna Saberi-Funded by UPenn-EHSCC, and will be published shortly;

Study [2] An inter-Center Pilot Project: "Groundwater Quality and health Outcomes in Adjacent Areas With and Without Hydrofracturing Activities" funded by Columbia EHSCC and UPenn EHSCC, with results in a year or two;

Study [3] An inter-Center Pilot Project: "Harvard WorldMap: Fracking Research Repository for All Concerned (HWM: FRRAC)" funded by Harvard EHSCC and UPenn .

Study [1] is being prepared for publication and studies [2] and [3] have just been funded, with results in a year or two.

The above studies are just beginning, but preliminary information will be available in approximately one year;

--the EPA HF study; an interim progress report was issued in December 2012 <http://www.epa.gov/hfstudy/pdfs/hf-report20121214.pdf> ; the study is funded and due to completed in 2016; this study focuses on the potential pathways of exposure related to water;

## PEER REVIEWED LITERATURE

Peer reviewed papers are the gold standard in medicine. The papers on the health impacts near gas drilling operations that are emerging include the work of our colleagues at Cornell, Michelle Bamberger and Robert Oswald, who documented several cases where chemicals associated with drilling were implicated in negative health outcomes in animals and people. [http://www.psehealthyenergy.org/Impacts\\_of\\_Gas\\_Drilling\\_on\\_Human\\_and\\_Animal\\_Health](http://www.psehealthyenergy.org/Impacts_of_Gas_Drilling_on_Human_and_Animal_Health)

One of the several cases they describe was the death of 17 cows within one hour from direct exposure to hydraulic fracturing fluid. The final necropsy report listed the most likely cause of death as respiratory failure with circulatory collapse. The hydraulic fracturing fluid that they drank contained petroleum hydro-carbons plus other toxins.

Another case documented was the death of companion animals with gas operations nearby—and road-spreading of waste was implicated.

Two cases provided unplanned but inadvertent control experiments—another standard in research-- since herds of cows were kept in different pastures. The cows that drank contaminated water had a high death rate, and a high rate of stillborn and deformed calves.

In one of the homes, a child became ill with fatigue, confusion, abdominal and back pain. After several animals in the household had died, the doctor became suspicious of toxins and testing revealed arsenic in the child. The family then stopped drinking the water despite results which showed the well water was safe and he eventually recovered, having lost a year of school. In these cases, there were 25 wells within two miles of the homes, and there was also the aerated impoundment, and two compressor stations within a mile. While checking for other toxins in these two homes, random urine tests on family members revealed phenol, a metabolite of benzene; symptoms observed by families in both homes included extreme fatigue, headaches, nosebleeds, rashes, and sensory deficits (smell and hearing). Were it not for the deaths of the animals, the human health effects would not have been found.

Their study illustrates several plausible links between gas drilling and negative health effects.

Drs Bamberger and Oswald are the guest editors of an entire edition of a journal called New Solutions, and it is dedicated to impacts of gas drilling. All raise concerns whether gas drilling as it is currently done is safe. <http://baywood.metapress.com/link.asp?id=k01404273056> (pre-publication, galley proofs can be found here).

Elaine Hill is documenting how proximity to gas wells affects birth weight, and she is finding that it does, and it is a negative impact which will likely cost the government healthcare dollars in the long run. <http://ourhealthandenvironment.wordpress.com/2012/07/21/fracking-and-low-birth-weight-preliminary-evidence/>

Medical colleagues in Utah are dealing with unprecedented levels of dangerous air pollution, estimating billions of dollars of additional healthcare costs due to exposure to ozone, PAHs, endocrine disruptors and other chemicals which will plague the population for generations. (personal communication, Utah Physicians for a Healthy Environment, wrote that they think the costs of air pollution in Utah, pop. 3 million, are already \$10 to 12 Billion; and Dr Kirtley Jones comments on health impacts on babies <http://environews.tv/dr-kirtly-jones-reveals-the-damage-caused-to-fetuses-and-young-children-by-elevated-air-pollution/> )

Early results from an on-the-ground public health assessment from the Southwest Pennsylvania Environmental Health Project (SWPA-EHP) indicate that environmental contamination is occurring near natural gas drilling sites and is the likely cause of associated illnesses.

According to this assessment, in one small county of about 200,000 people, 27 people thought they were getting sick and went to a single rural health clinic and fracking was determined to be a plausible cause.

Since drilling has only been going on for six years in this area, it does not include chronic illnesses that can take years to manifest.

The 27 cases documented by the Southwest Pennsylvania Environmental Health Project team are not a surveyed sample of the region's population, nor were they recruited to be part of a study. They are patients from a single rural clinic who came in seeking help. As such, these early figures could easily be the leading edge of a rising wave of human injury.

Mesothelioma from asbestos, thyroid cancer from radiation, mental retardation from lead poisoning, birth defects from the rubella virus — all these now-proven connections began with a handful of case studies that, looking back, were just the tip of an iceberg. We know that many of the chemicals released during drilling and fracking operations — including benzene — are likewise slow to exert their toxic effects. Detection of illness can lag by years or decades, as did the appearance of illnesses in construction workers and first responders from exposure to pollution in the 9/11 World Trade Center response and cleanup.

The early results from the Southwest Pennsylvania Environmental Health Project study implicate air contamination as the likely cause of three-quarters of the associated illnesses so documented. In some cases, significantly elevated levels of fracking-related air pollutants were found in the air inside of people's homes. This is an unacceptable problem: breathing is mandatory and, while a drinking water source might be replaced, air cannot.

A minority of cases suffered from likely exposures to tainted water, but these low numbers are not reassuring. Water contamination often takes a while to appear. Well casings continue to fail as they age — up to 60 percent over 30 years — and, as they do, we expect health effects from waterborne contaminants to rise and spread to more communities.

Given that exposures and illness increase over time and given that many instances of contamination and illness related to fracking never come to light due to non-disclosure agreements with the industry, we cannot accurately quantify the extent of our problems with gas drilling. But Washington County shows that they are here, and we have every reason to expect that they are not yet fully visible and they are growing. <http://concernedhealthny.org/category/press-releases/>

[www.concernedhealthny.org](http://www.concernedhealthny.org) and [www.psehealthyenergy.org](http://www.psehealthyenergy.org) list additional and updated peer-reviewed articles, reports and testimonies from health professionals, and please see more references at the end of this paper.

## **STRESSORS ON HEALTH FROM SHALE GAS EXTRACTION WHICH CANNOT BE ELIMINATED**

### **--ABANDONED WELLS --**

WELL CASING INTEGRITY –all wells will eventually leak since casings and cement are man-made and will not withstand decades of high-pressure and corrosive materials. Abandoned wells include ignored wells; it would be extremely costly to plug all of them, and the locations of many are unmapped.

**--AIR and WATER CONTAMINATION** --cannot be 100% contained with current use of triple casings; chemical leakage will follow the methane leaks which have been documented and occur with regularity.

FLARING –releases chemicals, creates particulates and causes symptoms (observed by health professionals); at issue are the unknown chemicals, exemptions, and the fact that the technology does not exist for alternatives.

DIESEL EXHAUST --from trucks, compressors, processing plants; no cumulative impacts have been considered, yet it is clear that there are health impacts from these emitters; modeling has shown that impacts may be experienced at six miles; diesel exhaust is now considered a definite carcinogen.

WATER CONTAMINATION –residents have barium, arsenic, VOCs, methane, radionuclides and other toxins in their water wells claimed to be a result of drilling nearby, and which is denied by industry; residents whose blood results I have seen have these in their blood.

AIR POLLUTION --has been shown to be associated with neurodevelopmental disorders, lower IQ in babies born to mothers with polycyclic aromatic hydrocarbon exposure during pregnancy, and learning disorders in exposed children. (see references at end of paper).

The American Academy of Pediatrics notes that children are especially vulnerable because their lungs continue to grow and enlarge until about age 18. Plus children breathe faster and are closer to the ground. As they mature in the presence of ozone, alveolar production is reduced, and the result of chronic ozone exposure can be brittle lungs like those of an elderly adult.

And since the World Health Organization has now classified diesel exhaust as a definite carcinogen, it raises additional concerns for workers and other vulnerable groups exposed to diesel exhaust.

Silica is the sand that is used in hydraulic fracturing. It is mined in Minnesota and Wisconsin and is not regulated as a hazardous pollutant by the U.S. Environmental Protection Agency. NIOSH has identified exposure to crystalline

silica during hydraulic fracturing as the most significant known health hazard to workers. It is also a hazard to the workers in the Midwest mining it and to the residents living nearby.

Inhalation of fine dusts of crystalline silica can cause silicosis which is an incurable lung disease. It's also been determined to be a lung carcinogen.

--**ACCIDENTS**—happen, even with best management practices and regulations.

--**CHEMICALS** —including both introduced and those from down-hole; related to DIESEL and AIR CONTAMINATION; federal exemptions limit information; observed symptoms include respiratory, cardiovascular and/or neurologic problems; interaction of chemicals with other chemicals and with naturally-occurring substances have not been studied (limited by NDAs and federal exemptions).

ENDOCRINE-DISRUPTING CHEMICALS (EDCs)—a large percentage (about 40% according to Dr Theo Colborn) are EDCs which impact children and the unborn disproportionately.

FOOD CHAIN CONTAMINATION —animals are sentinels; soil farming with gas well waste occurs with some regularity, as does road spreading.

The toxic chemicals are classified as secret, or proprietary, which hampers health studies, but we know it includes known or suspected carcinogens, mutagens, neurotoxins, hazardous air pollutants, and endocrine disruptors which have effects at very low doses.

**COMMUNITY IMPACTS** – Besides the environment, community well-being is another major determinant of health.

In areas where the drilling has occurred it has splintered the residents into the minority who benefit financially-- like those who have leased large acreages, some businesses like motels and diners, those who get jobs in the industry, drug traffickers, and politicians who are given money for their campaigns. But those who lose are the majority—homeowners who have lost their water, the value of their homes and their health. The stress of not knowing if and when that loss will occur is also significant, and research provides evidence that such stress can negatively impact a person's health. People already under stress from an underlying illness, or poor socioeconomic status, or because they are simply very young or very old and therefore a vulnerable population, suffer environmental and societal impacts less well than people who are not so stressed.

There is also the potential loss of traditional, sustainable jobs, such as in tourism and farming which could be displaced when a high impact industry such as gas extraction moves into a region.

VULNERABLE POPULATIONS AND SOCIAL JUSTICE – this extractive industry not only impacts vulnerable populations in a disproportionate way, it also creates vulnerable groups, eg, sick workers, small-for-gestational-age babies, etc .

WORKER HEALTH -- these workers are part of the community and their ill-health taxes the family and the community, and eventually the state.

SILICA USE – highly toxic to workers and community where it is mined, stored and used.

ECONOMIC BUST –few years of prosperity for some (but there will be inequity), and then there will be a bust (documented).

--**HUMAN ECOLOGY**--

- Vulnerable populations are created but not protected
- Economics impact human health
- Food chain contamination will eventually impact humans
- Occupational safety --the on-the-job fatality rate of oil and gas workers is eight times higher than the rate for all U.S. workers, as reported by the Centers for Disease Control.

--**NOISE POLLUTION** --EU study links noise to CV and neurologic ill health [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0008/136466/e94888.pdf](http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf)

--**PATHWAYS OF EXPOSURE** exist but their identification is limited by non-disclosure agreements (NDAs) and federal exemptions, as well as limited funding for research;

- Source of contamination: Cement casing leaks >7% PA wells/abandoned wells
- Environmental media and transport mechanism: Soluble/volatile and particulate. slickwater. Drilling muds. Flowback/produced water/Waste
- Points of exposure
- Route of exposure
- Receptor population – human ecology

--**RADIOACTIVITY** -- high radon in indoor air, gas and in water from the Marcellus shale area already exists. <http://pubs.usgs.gov/of/2009/1257/pdf/ofr20091257.pdf>, [http://pubs.usgs.gov/of/2012/1150/pdf/ofr2012-1150\\_report\\_508.pdf](http://pubs.usgs.gov/of/2012/1150/pdf/ofr2012-1150_report_508.pdf), <http://pubs.usgs.gov/sir/2011/5135/pdf/sir2011-5135.pdf>

A federal exemption to the Resource Conservation and Recovery Act allows anything that has come from down hole to be exempt from hazardous classification.

--**STRESS** (related to everything) – leads to depression and other mental health issues

--**WASTE** – NY is already receiving toxic waste from PA, and this process is inadequately controlled; there is no place to safely put the waste due to radioactivity, heavy metals, TDS, VOCs; road spreading and soil farming are unacceptable (animals have died).

For decades we have known the Marcellus shale to be more radioactive than other shales. The radioactive elements found in Marcellus shales include uranium, thorium, radium and also radon.

Radon is the leading cause of lung cancer among non-smokers and the second leading cause among smokers, and accounts for 21,000 lung cancer deaths per year on a nationwide basis, according to the EPA. Also from the EPA, we know that areas overlying the Marcellus shale have high indoor radon, on average, already, and will be at risk if exposed to radon additionally via delivered gas which we believe will be higher in radon than is safe. The only “safe” level of radon is “0 picoCuries/L”. No environmental or health agency is tracking the radioactive exposure at the well site (radon and radium), in pipelines (radon, radium, lead, polonium) or at end use—people’s homes (radon).

The press has exposed industry practices such as dangerous disposal of radioactive waste (NYTimes). A federal exemption to the Resource Conservation and Recovery Act allows anything that has come from down hole to be exempt from hazardous classification. So this waste, including radioactive drill cuttings and sludge, can be spread on roads, buried on site, released into streams or sent to town dumps or POTWs which can leach into drinking

water. And there's the underground injection of toxins which then contaminate drinking water which Propublica has exposed.

## **EMERGING HEALTH STUDIES ARE VITAL**

So why is gas drilling with HVHF proceeding when scientific evidence is pointing to such significant community and environmental hazards?

In 2005, Congress passed the Energy Policy Act, also known as the Halliburton loophole (Cheney retired from Halliburton in July 2000, when he was tapped by Bush for the vice-presidency) <http://www.msnbc.msn.com/id/8870039/#.UMTpQoM8CSo>

In effect, the 2005 Energy Policy Act exempted the oil and gas industry from key provisions of the most important environmental and public health laws, such as the SDWA, CAA, CWA, RCRA, NEPA, CERCLA aka Superfund, and others. The federal exemptions were passed seven years ago (Highlights of Oil and Gas Industry Exemptions From Federal Statutes [http://www.citizenscampaign.org/PDFs/cce\\_hvhf\\_wp\\_final.pdf](http://www.citizenscampaign.org/PDFs/cce_hvhf_wp_final.pdf)), and during that time the oil&gas industry has been minimally overseen. So we do not know the extent to which health or environmental impacts have occurred, though we know that people in close proximity to oil and gas exploration and production activities perceive that they have been negatively impacted.

Other reasons for the paucity of scientific information:

--Most of the peer-reviewed literature on health impacts has been published only in the last 1-2 years.

--Research funding has been limited.

--State regulations vary but so far have not included health literature, doctors and public health professionals. In fact, in Pennsylvania there is a gag order to be imposed on physicians if information to assist in the treatment of a patient is disclosed to that doctor, and Colorado seems to be following suit.

--We know that accidents happen and violations occur, despite the best regulations.

--Non-disclosure agreements hamper access to important information. <http://www.post-gazette.com/stories/business/legal/washington-county-judge-orders-marcellus-shale-development-settlement-records-unsealed-680087/?print=1>

Another obstacle has recently emerged in certain states, and that is limiting the information that doctors can share if they receive vital chemical information from industry in order to treat their patients. In Pennsylvania and Colorado, doctors are required to sign a non-disclosure agreement in exchange for life-saving information. <http://www.motherjones.com/environment/2012/03/fracking-doctors-gag-pennsylvania> and [http://www.denverpost.com/environment/ci\\_22827696/colorado-docs-chafe-at-secrecy-oath-needed-access#ixzz2O658UeCK](http://www.denverpost.com/environment/ci_22827696/colorado-docs-chafe-at-secrecy-oath-needed-access#ixzz2O658UeCK)

It has come to the point that non-governmental organizations are engaging in research: Earthworks just published a paper on a survey done in Pennsylvania which demonstrates negative health impacts close to wells. Amy Mall of NRDC has a list of hundreds of cases of water contamination; Damascus Citizens for Sustainability is doing baseline methane monitoring in select localities.

## IMPACTED PEOPLE

People near gas drilling sites in Pennsylvania, Colorado, Texas and other states have had a rash of unexplained illnesses, sick and dying pets and livestock, contaminated drinking water, unacceptably high ozone in areas that were known previously for their pristine air quality, lost homes and shattered communities.

I have spoken with impacted families who have become ill since their air or drinking water became contaminated after a gas well was drilled near their home, or compressor stations erected nearby, and referred them for further evaluation in New York City's Mt Sinai Hospital, as well as to the Southwest Pennsylvania Environmental Health Project (SWPA-EHP) <http://www.environmentalhealthproject.org/>. these people have skin lesions, headaches and other neurological problems;

--there are those with breathing problems when gas wells are vented;

--and a pregnant woman who was having seizures, and was surrounded by gas wells;

--and the mother of a child with arsenic in his blood; that family was also dealing with water that had turned after drilling, and with dead and ill animals;

--and there are others that we know about, and the only advice to offer them is not to drink the water—but we can't advise people to stop breathing the air.

--I have also spoken with a woman in Erie Colorado whose family has had exacerbations of asthma and recently they've begun experiencing neurological problems; Erie CO has many gas wells and compressors [http://www.denverpost.com/business/ci\\_20553795/colorado-join-studies-air-quality-around-oil-and](http://www.denverpost.com/business/ci_20553795/colorado-join-studies-air-quality-around-oil-and) .

--Last year I travelled to Paradise Road in Wyalusing, Bradford County to speak with a group of people who had leased and who already had contaminated water--many of the homes on Paradise Road had visible water buffaloes. Shockingly, these people had never spoken with a doctor about their water contamination and the possible health implications. The couple hosting this gathering was expecting a baby... A few months later we learned that the baby was born with a cardiac defect. Chance? Perhaps...but maybe not...and no public health, state or federal agency ever asked about the environmental history.

--Over the past week I have spoken with two families. These are their stories:

The first family was well, living modestly on family-owned land which sits in a valley, until 2008. The children were average to very good students, with excellent attendance records.

Although rural, this area was a coal mining region.

In 2005 an electric compressor was placed on the hill above their home, about 500-700 ft away.

In 2008 two gas compressors joined the first one on the hill. Also in 2008 five gas wells were spudded and completed on another hilltop, less than one-half mile away from the house, plus a glycol dehydrator and a sludge tank.

Around the end of 2008, and early 2009, the mother and grandmother began observing changes, subtle at first, in the children, as well as in themselves.

Over the course of the years since 2008/2009, there have been odor events noted numerous times. The odors have been chlorine-like, and at other times sweet-smelling. These occur almost every day. It may be preceded by a vapor mist, which appears to have tiny bubbles, that comes downhill from the compressors. On occasion there are what the family would characterize as extremely odorous events, where it is difficult to breathe. Significant health impacts occur right after such events.

One of the twin sons, who was an average student with perfect attendance, developed headaches, rashes and behavior changes, beginning in 2008/2009. These were minor at first, but have worsened. He began missing school and was more difficult to manage. In 2012 he began having involuntary movements that appeared tic-like, tremulousness on occasion, shaking hands and seemed to lack coordination. He had a neurological work-up and is under the care of a neurologist who prescribed an anti-seizure medication. He has recently been evaluated by the Individualized Education Program (IEP) team at school because of poor performance.

The other twin has had a similar course as his brother. He also developed abnormal movements a short while later than the first twin, and he is also being treated with the anti-seizure drug. After having been an honors student, he is also now undergoing an IEP evaluation. The twins currently weigh about 90 lbs, and have had very little, if any, weight gain in two years.

A 13 yo son suffers from severe headaches for which he is medicated, and he has lost days of school. Since last week he has also had abnormal movements and just had an EEG and he was also started on the anti-seizure meds. He is also very sensitive to noise; his room faces the compressors and therefore receives the most noise. When the compressors are running, which is most of the time, the family describes the noise as similar to ten trains. The blowdowns occur without notice.

An 18 yo daughter began having behavior problems and slowed speech at age 16. An evaluation by the neurologist included an EEG and MRI, and revealed that she had had a stroke.

A 20 yo daughter and not living in the house for the past year, but lives not far and visits, has had headaches, abnormal hand movements, leg pain and memory problems.

The mother was also previously healthy. Over the past few years she has had gastrointestinal problems (improved when she stopped drinking the water) and has lost about 50 lbs. In 2010 she noted a very strong chlorine-like smell which "took her breath away" and to which she was exposed for about 2 to 3 minutes. She felt ill immediately and shortly thereafter developed congestion, and blisters in her nose, on her neck, face and arms (exposed skin areas). About three months later, because she was pale and had continued blistering of the mucous membranes, particularly the nasal mucosa, she returned to the hospital. Following an evaluation, the health professionals recommended that the family evacuate the house and also a Hazmat team visit, but none appeared. The mother has also seen the neurologist for weakness, memory problems, trembling hands and a feeling described as "bugs crawling on the skin". She has been diagnosed with polyneuropathy and is on medication.

The grandmother has hypertension and tachycardia, and is on medication for these conditions.

In 2010 the mother and grandmother both had bloodwork for environmental toxins. The grandmother had phenol, benzene, arsenic, and cadmium in her blood; the mother had phenol and benzene. The children were not tested.

All the family members have had rashes which appear occasionally, described as red, occasionally slightly raised. The family recalls one specific episode of these rashes in the children, in 2010, following another chlorine odor event.

On July 3<sup>rd</sup> of this year there was a strong sweet-smelling odor event that was followed by diffuse red rashes in the boys who had been playing outside. One boy developed a boil in the groin which improved, in time, after two rounds of antibiotics, but recently another boil developed. The other boy developed a boil and cellulitis in the axilla this past week. They never had such infections.

Additional Environmental History:

GAS WELLS—there are five on the opposite hill which were fracked in 2008, during which time there were two frack ponds. In 2009 a neighbor whose house overlooked the ponds noticed that a creek that runs between his house and this family's house suddenly flooded and the water turned black in the creek. This creek is 15-20 ft from their yard.

PETS—There is a small dog owned by the grandmother who, whenever he had been outside, was seen licking his paws afterwards, and then he would vomit. The dog no longer wants to go outside, especially when the decking is moist from rain or what appears to be dew, but could be the vapors that come down the hill from the compressors (often noticed in the evenings), as they also cover the house with a moist film. The grandmother separately noticed that when she took the plant covers from her tomatoes, that covering, which often had some moisture on it, burned her hands.

The family has not been evaluated by any public health agency, although DEP takes spot air samples.

The second family works in the industry. The husband does construction work as a sub-contractor. He describes one episode where his crew were doing work and there was a blowback, a foggy material was released and covered the ground, and the accompanying fluid spraying his workers with a burning fluid. He had no idea what the material was, and they were not wearing any protective gear.

He has seen too many dead cows and deer not far from gas development areas, he says.

But the story is about his wife. About five years ago, the wife took a job painting glycol dehydrators, well heads, brine tanks and other infrastructure on working well sites and compressor stations. Immediately following one of the first jobs, as she started the drive home, she felt nauseated, developed a severe headache, a sore throat and by the time she got home she was covered in rash on all the exposed parts of her body. Eventually some of the red rash evolved into open sores. These came and went. The husband reports that she has the scars from these sores. The wife stopped going on these jobs after several of these episodes. Then, she started to have behavior changes—irritability and forgetfulness. She has now been diagnosed with dementia, and is in a doctor's care and being medicated for that.

About four years ago she developed an excoriated area on the top of her ear, which seemed never to completely heal. At this point, the top of her ear is gone, and two days ago the lesion was biopsied for cancer.

Her case has never been reported to any public health agency.

--The List of the Harmed has over a thousand “anecdotes”. <http://pennsylvaniaallianceforcleanwaterandair.wordpress.com/the-list/>

Those of us who have been following this issue closely know of many cases of illness near gas drilling operations and most are called anecdotes because pathways of exposure have not been identified, which is when you don't have a link from the toxin to the illness. Those links are not yet proven because research on health impacts is just now emerging. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3339470/>. Also, doctors who are practitioners haven't been educated on environmental issues and do not routinely take an environmental history, which is necessary if a causal effect is ever to be established. As an end result and most importantly, the complaints of the patients are not investigated by those tasked with protecting public health. And, if patients complain directly to the companies, and the families receive compensation, the records of the transactions are often sealed through non-disclosure agreements.

Prominent scientists who have been at the forefront of both research and patient care recently wrote to the Albany Times Union.

In “*Assessing the risks of fracking*”, Dr David Brown (SWPA-Environmental Health Project) points to several lessons learned <http://www.timesunion.com/opinion/article/Assessing-the-risks-of-fracking-4342593.php>.

“*Beware impact of fracking*” is a commentary urging caution from Dr Theo Colborn (The Endocrine Disruption Exchange), and Nadia Steinzor (Earthworks) <http://www.timesunion.com/opinion/article/Beware-impact-of-fracking-4324911.php?cmpid=twitter>.

Even without proving a direct relationship, in other words, a particular chemical (which is secret) caused this person's illness, we can attribute a person's illness to the gas development nearby by following these three guidelines:

- **Temporal relationship** – was the development of the symptom (or exacerbation of pre-existing symptom) after the onset of gas extraction activities
- **Plausible exposure** – is there an identifiable exposure source in proximity to the individual experiencing symptoms
- **Absence of a more likely explanation** – Symptoms were not attributed to gas extraction activities if an individual had an underlying medical condition that was as (or more) likely to have caused the symptom.

There are many such cases, and they fit the criteria of having been impacted by gas development nearby: **a temporal relationship, plausible exposure, and absence of a more likely explanation**. Studies implicate air contamination as the likely cause of three-quarters of the illnesses. Breathing is mandatory, and, while a drinking water source might be replaced, air cannot.

Having spent time speaking with these impacted people, I am convinced that the health of many of them living near gas wells, processing plants and compressors is deteriorating and that it is a result of gas drilling activities. These people were well before this industry moved in, and now they are not, and there is no other plausible reason for their illnesses. Given that exposures and illness increase over time and given that many instances of

contamination and illness related to fracking never come to light due to non-disclosure agreements with the industry, I am afraid that this is the just beginning of a huge public health crisis. I believe that some have irreversible neurological problems already. I implore you not to create a generation of people who are industry's lab rats with governmental complicity--young people who would otherwise be happy and thriving and productive members of society, and instead will be on disability and dependent on the welfare system. They did not ask for this nor consent to experimentation.

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09/11/13

## **5. Global Warming Effects of Unconventional Shale Gas Development by Professor Anthony Ingraffea**

Presenter – Mav Moorhead

Support for natural gas development appears to be based on the mistaken premise that natural gas is a “clean” fossil fuel, that it is “good” in our efforts to combat climate change. These are characterizations that shale gas cannot claim when fugitive methane emissions from development, transportation and use are taken into account.

Methane is a far more powerful greenhouse gas than carbon dioxide. For the first 20 years of its lifetime in the atmosphere, one pound of methane traps as much heat as at least 80 pounds of CO<sub>2</sub>. Its potency declines until it is about 25 to 30 times more powerful than CO<sub>2</sub> over a hundred years. Although when burned gas emits half the CO<sub>2</sub> of coal, methane leakage eviscerates this advantage because of its greenhouse power. (Shindell et al., 2009)

And methane is leaking. At the downstream end of the methane life-cycle, recent measurements in Boston, Washington, DC, and New York City have revealed a shocking number of leaks in aging distribution pipelines and methane concentrations in the air in these major cities up to 5 times the natural background level (Phillips et al. 2013; Ackley and Payne, 2013). Recent field measurements led by scientists at the National Oceanic and Atmospheric Administration (NOAA) have found upstream/midstream only (not including transmission and distribution losses) emissions in a region of Colorado between 2.3 and 7 percent of production; upstream/midstream emissions only up to 9 percent in Utah; and upstream/midstream/downstream emissions up to 17 percent in the Los Angeles CA basin (Petron et al., 2012; Nature, 2013; Peischl et al. 2013).

These measurements validate the range predicted in the seminal paper on this topic published by scientists and engineers at Cornell

University in 2011 (Howarth et al. 2011; Howarth and Ingraffea, 2011; Howarth et al. 2012; Howarth et al., 2012). A subsequent 2011 study from the National Center for Atmospheric Research (NCAR) concluded that unless leaks can be kept below about 2%, gas lacks any climate advantage over coal (Wigley, 2011). A 2012 paper from the Environmental Defense Fund pegs this crossover rate at about only 3% (Alvarez et al., 2013). A recent study by the science group Climate Central shows that the alleged 50% climate advantage of natural gas is unlikely to be achieved for many decades, if at all (Larson, 2013).

Unfortunately, we don't have that long to address climate change—the next two decades are crucial. Shindell et al. (2012) note that the climate system is more immediately responsive to changes in methane (and black carbon) emissions than carbon dioxide emissions. They predict that unless emissions of methane and black carbon are reduced immediately, the Earth will warm to 1.5° C by 2030 and to 2.0° C by 2045 to 2050 whether or not carbon dioxide emissions are reduced. Reducing methane and black carbon emissions, even if carbon dioxide is not controlled, would significantly slow the rate of global warming and postpone reaching the 1.5° C and 2.0° C marks by 12 to 15 years. Controlling carbon dioxide as well as methane and black carbon emissions further slows the rate of global warming after 2045, through at least 2070. The life-cycle of shale gas produces all three of these climate change culprits: carbon dioxide, methane, and black carbon.

While it is possible to reduce fugitive emissions from shale gas development, the technologies to do so have not been embraced by operators because the costs are prohibitive from their view. For example, in 2012 the industry demanded a delay from the EPA until January 1, 2015 of the mandatory implementation of the simplest of these technologies: green completions. It is also certain that any efforts to adequately regulate the industry will be vigorously opposed by this well-resourced industry and its lobbyists.

The other unfounded assumption of some shale gas promoters is that natural gas is a bridge fuel to a cleaner low carbon economy.

Not only does the evidence show that shale gas development is more problematic than continued use of oil and even coal, certainly over the short term, the supposed bridge period, there is no scientific basis for assuming that curbing methane emissions will be easier than implementing the conservation, efficiency and renewable energy strategies that will reduce our reliance upon fossil fuels including natural gas.

We have renewable wind, water, solar and energy-efficiency technology options now to avoid the enormous risks of fracking for shale gas (Jacobson et al., 2013). We can scale these quickly and affordably, creating economic growth, jobs, and a truly clean energy future to address climate change. Political will is the missing ingredient. Meaningful carbon reduction is impossible while the fossil fuel industry has captured too much of our energy policies and regulatory agencies, plus intentionally distorted public debate. Policy-makers, including the President, need to listen more closely to the voices of independent scientists over the din of industry lobbyists.

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September 11, 2013

## DRBC Public Hearing Comments

In Dec of 2012, The AP reported that a USGS team based in Menlo Park, CA found that a quake in Colorado and a damaging 5.6 magnitude earthquake in Oklahoma were induced by underground disposal of fracking waste. A detailed report by Young Kim of The Lamont-Doherty Laboratory (published in the Journal of Geophysical Research) in concert with USGS concluded that the occurrence of over 100 earthquakes within a 14 month period near Youngstown, Ohio were also the result of fracking waste injection wells. Scientists concluded that 95 quakes in the Raton Basin between 2001 and 2011 were also the result of deep injection of oil and gas drilling waste. USGS scientists concluded that most quakes this past decade were located within 3 miles of an active wastewater injection well. USGS scientist Justin Rubinstein, co-author of the report said that "This is a societal risk you need to be considering. At the moment we're the only people who have done this work and our evidence is pretty conclusive."

The same thing is happening elsewhere in the US including Arkansas, West Virginia, Texas and Wyoming where there are injection wells. ProPublica reported that "Records from disparate corners of the US show that wells drilled to bury this waste deep beneath the ground have repeatedly leaked, sending dangerous chemicals and waste gurgling to the surface or on occasion, seeping into shallow aquifers that store a significant portion of the nation's drinking water." The waste is comprised of millions of gallons of water mixed with toxic, carcinogenic chemicals combined with "produced water" that comes to the surface during fracking operations. "Produced water" has high levels of BTEX chemicals, and salts such as chloride and bromides and heavy metals and is also radioactive.

Migration of fluids from wells have been documented to travel faster and farther than researchers thought possible. In a 2000 case that wasn't caused by injection but brought important lessons about how fluids could move underground, hydrogeologists concluded that bacteria-polluted water migrated horizontally underground for several thousand feet in just 26 hours, contaminating a water supply in Walkerton, Ontario and sickening thousands of residents.

Deep well injection takes place in 32 states from PA to CA. The energy industry has its own injection well category, Class 2, which includes disposal wells and wells in which fluids are injected to force out trapped gas and oil. All hydrofracked gas wells are injection wells. Class 2 is very lightly regulated, a problem that allows unsupervised injection operations - one of the contributing factors of the fatal contamination of 38-mile long Dunkard Creek.

Tom Myers, a hydrologist, drew on research showing that natural faults and fractures are more prevalent than commonly understood to create a model that predicts how chemicals might move in the Marcellus Shale. Myers new model said that chemicals could leak through natural cracks into aquifers tapped for drinking water in about 100 years, far more quickly than had been thought. In areas where there is hydrofracking or drilling, man-made faults and natural ones could intersect and chemicals could migrate to the surface in as little as a few years - or less. "It's out of sight, out of mind. Simply put, they are not impermeable, it's not a matter of if fluid will move through rock layers, but when." he said referring to injected waste and the rock layers.

Until recently injection wells were not considered suitable in the PA geology and wastewater from fracking has been shipped to the injection wells in Ohio (which are the subject of earthquakes). But a recent change in policy - certainly not geology, has paved the way for the installation of fracking wastewater wells in PA. That means that if PA regulations were to be implemented in the DRB there would be fracking and injection wells here in the basin.

The DRB is within a seismically active region that has a documented history of earthquakes. Fracking induced earthquakes and migration of toxic fluids as a result, in addition to the risks that earthquakes pose to potentially hundreds or thousands of gas wells is much too dangerous a risk and should cause this commission to ban fracking in this basin.

Joe Levine,  
Damascus Citizens

Reference attachments

**Testimony Submitted to the Delaware River Basin Commission. September 11, 2013**  
**By Elisabeth N. Radow, Esq. [enradow@radowlaw.com](mailto:enradow@radowlaw.com); [www.radowlaw.com](http://www.radowlaw.com)**

My name is Elisabeth Radow. I am grateful for the opportunity to submit testimony to Executive Director Carol Collier on behalf of the Delaware River Basin Commission (DRBC). I am a lifelong New Yorker, the managing attorney of Radow Law PLLC and a mother. I chair the Committee on Energy Agriculture and the Environment for the League of Women Voters of New York. The League of Women Voters of New York, New Jersey, Pennsylvania and Delaware have submitted joint testimony to the DRBC previously. Today I submit testimony on my own behalf. My work has been sourced and cited in national publications such as the New York Times, Huffington Post and MORE Magazine and has been published in several law journals. My law practice includes real estate development, real estate finance and increasingly, the effects of gas drilling operations on property ownership.

The basis for my testimony today comes from my research identifying the impacts of unconventional shale gas drilling on property value, risk allocation between the gas drilling company and the homeowner and the increasing inability of homeowners to obtain and maintain a mortgage and homeowners insurance in the presence of gas drilling.

The majestic Delaware River provides drinking water to 15 million people. The responsibility of the DRBC as stewards of this water supply for so many Americans is an awesome one. What I wish to stress is that how the DRBC discharges that obligation will also profoundly and permanently affect the ability of all citizens living in the Delaware River Basin states to have a safe place to call home. Across America, in shale rich-states, property ownership is being revolutionized by the proliferation of the multi-step, heavy industrial drilling operations on the land surface and subsurface of private homes and farms.

Home represents a family's most valuable asset, financially, spiritually and otherwise. From a property value standpoint, think of home as a bundle of rights: the right to construct, obtain a mortgage loan, lease and sell the property; the right to clean running water, electricity, a roof over ones' head; a safe place to raise children, crops or cattle, or all of the above. Americans pay for these rights when we purchase our property, and expect these rights to continue until we sell. We want the property value to increase. So does the state. Our tax base depends upon it. Now there is mounting evidence that banks will not extend mortgage loans and insurance companies will not renew homeowners' insurance policies for homeowners with gas leases and in some cases their neighbors without gas leases. These trends have potentially grave implications for community vitality and personal wealth in areas with fracking and must be examined and clearly understood by policy makers such as the DRBC.

What about unconventional shale gas drilling is producing these threats to homeowner and community wealth and security? Up to now, home has represented the one place people have control of the destiny of their economic assets. Standard gas leases grab homeowner control of property use by giving the gas company the right to establish surface operations, create perpetual, unfunded, road and utility easements, and the right to store gas underground from any source. The standard leases do not require the gas company to fund or perform the maintenance, repair and ultimate restoration of the easements and other surface uses. So that expense stays

with the property owner. They give the gas company the free right to sell the lease or take in investors without homeowner consent. This means the homeowner has no control over who comes onto their private property to drill, or the quality of the work they perform.

Gas drilling introduces hazardous activity and hazardous substances, practices which are expressly prohibited by standard mortgages. Consider that while the mortgage lender expects the home to retain its value for the 30 year life of the loan, a gas driller, and by extension its investors, on that very same property, cares more about extracting the most gas for the least expense and least regulation.

Publicly traded gas company 10-K's filed with the Securities and Exchange Commission characterize the drilling lifecycle as subject to many risks. The list of hazards includes: blow-outs, explosions, pipe failures and uncontrollable flows of natural gas, or well fluids. The same public disclosure documents report that the gas drillers are not fully insured for their operations and fail to state that they have available cash reserves to pay for uninsured casualties, property damage and environmental pollution resulting from their operations.

Well-water contamination can occur at one or more points in the drilling process, including from leaks, spills and cracked well casings and the inappropriate road spreading, disposal and treatment of the toxic, radioactive hydraulic fracturing waste. A recently released EPA power point presentation of its Dimock PA water analysis reflects an apparent nexus between gas drilling operations and contaminated water. <http://desmogblog.com/2013/08/05/censored-epa-pennsylvania-fracking-water-contamination-presentation-published-first-time>. As is currently happening, properties without potable water will lose substantial value and farms without potable water will fail causing personal economic catastrophe. If this impact continues, it could have major ripple effects on the tax base.

While water contamination from gas drilling operations is the most discussed and most obvious adverse impact to a home's use and value, structural damage to the residence represents another cause for concern. Gas drilling operations involve seismic testing which causes vibrations, moving earth, use of explosives, drilling wells and fracturing shale using extreme high pressure and deep well injection of the toxic waste, where permitted. For example, the Youngstown, Ohio region logged more than 100 earthquakes in 2011 which have been linked to deep well injection of hydraulic fracturing waste. <http://www.nbcnews.com/science/fracking-practices-blame-ohio-earthquakes-8C11073601?ocid=msnhp&pos=4> According to the US Geological Survey, "the number of earthquakes has increased dramatically over the past few years within the central and eastern United States. More than 300 earthquakes above a magnitude 3.0 occurred in the three years from 2010-2012, compared with an average rate of 21 events per year observed from 1967-2000. USGS scientists have found that at some locations the increase in seismicity coincides with the injection of wastewater in deep disposal wells." [http://www.usgs.gov/blogs/features/usgs\\_top\\_story/man-made-earthquakes/](http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/)

Any of these invasive gas drilling operations can cause a home's foundation to falter and walls to crack making the residence unsafe to inhabit. For example, recently, two couples in Johnson County, Texas filed a lawsuit for property damage allegedly resulting from fracking-related earthquakes.

While there is no government sponsored registry of gas drilling related impacts to homeowners, these accounts abound. Many are reflected on the FrackTracker Internet database. I am providing the link so the DRBC can review and confirm the mounting accounts.

<http://www.fracktracker.org/2013/03/pacwas-list-of-the-harmed-now-mapped-by-fracktracker/>

Standard gas leases fail to mention insurance. Homeowners remain potentially liable for the activity that occurs on their property, if it is not effectively delegated to the gas company in the lease or effectively addressed by the gas driller. Homeowners insurance excludes from coverage industrial activity and leaves homeowners vulnerable to losing their insurance coverage. This was confirmed in a July 2012 press release by Nationwide Mutual Insurance Company stating that:

Nationwide's personal and commercial lines insurance policies were not designed to provide coverage for any fracking-related risks..... From an underwriting standpoint, we do not have a comfort level with the unique risks associated with the fracking process to provide coverage at a reasonable price. Insurance is a contract and it is designed to cover certain risks. Risks like natural gas and oil drilling are not part of our contracts, and this is common across the industry.

<http://www.nationwide.com/newsroom/071312-FrackingStatement.jsp>).

This fact was reconfirmed in a March 2013 news report which stated: Fracking-related damage, insurance industry insiders say, is not covered under a standard homeowner's insurance policy. Neither is damage caused by floods, earthquakes or earth movement, which insurers call exclusions. "(Fracking is) deemed an exclusion in the same way earthquake or earth movement is," according to the Insurance Information Institute, a nonprofit institute funded by the insurance industry. According to State Farm Insurance, the insurance underwriter does not have a fracking endorsement for private residences. While State Farm does have earthquake, earth-movement and sinkhole endorsements available in most areas, the endorsement may not cover fracking related impacts. [http://m.shalereporter.com/industry/article\\_2cbf4e02-4f96-52cb-9264e169b706b05a.html](http://m.shalereporter.com/industry/article_2cbf4e02-4f96-52cb-9264e169b706b05a.html)

In August 2013, Lebanon, New York's town supervisor Jim Goldstein disclosed in an open letter that a constituent had their homeowner's insurance renewal for their home and farm in Lebanon denied because there is a gas well on their property. Mr. Goldstein confirmed through the insurance agent, who writes a lot of policies in southern Madison County, that this is a new trend and will come up as property owners fill out renewal applications. The property owner reported no history of payment problems or incidents on the property.

90% of all mortgage loans are sold into the secondary mortgage market. The standard mortgage used in the secondary mortgage market prohibits the transfer of an interest in the real property (which includes entering into a gas lease) without lender consent; and the presence of hazardous materials and hazardous activity consistent with the practices characterized by unconventional gas drilling operations. People with mortgage loans who signed gas leases without lender consent violated their mortgage; yet, as long as the borrower pays the loan, the lender may not become aware of the default. However, a mortgaged residence without homeowner's insurance constitutes an incurable mortgage default. If the homeowner/borrower cannot obtain replacement coverage in the marketplace, he or she would have to pay the substantially more expensive

“forced insurance” premiums arranged through the originating bank or loan servicer (which coverage inures only to the benefit of the bank, not the homeowner), or risk losing the mortgage loan altogether and face foreclosure.

What if a homeowner doesn't have a mortgage yet, but wants one? Because most loans are sold by the originating lender into the secondary mortgage market, mortgage loans are underwritten based upon guidelines issued by the secondary mortgage market. These guidelines have restrictions which could put the originating bank on the hook for buying back the loan if a homeowner allows gas drilling after obtaining a mortgage and the gas drilling results in well water contamination, structural damage or other property damage, or the home becomes uninsured. In recognition of the risks, some national banks are taking precautions when asked to loan on properties with gas leases; others are just saying “no” to residential mortgage loans with residential fracking. Because the property's conformity to secondary market standards will be questioned, an originating lender who elects to make a mortgage loan is more likely to keep the loan in its private loan portfolio and not sell it into the secondary mortgage market. With finite reserves, originating banks can make only a limited number of portfolio loans.

One national bank is taking charge of borrowers who sign a gas lease while also having an outstanding mortgage: Sovereign Bank, N.A., now requires borrowers to sign and record a mineral, oil and gas rights rider to the mortgage which stays in effect for the duration of the mortgage. It prohibits leasing the surface and subsurface of the property for minerals, oil or gas extraction; and requires the borrower to take affirmative steps to prevent renewal or expansion of rights under any existing lease or similar prior grant. The covenant restricting this use entitles the bank to bring the property back into conformity and requires the borrower to pay all bank and attorneys' fees incurred as a result.

Key Bank's Mortgage Group has lending guidelines which provide:

No mortgages will be written on properties that have a gas well.

Key Bank can deny a mortgage to homeowners whose properties are within 600 feet of a gas well.

No mortgages will be written on properties with a gas lease.

Property owners with gas leases and gas companies can be held liable for damages.

<http://neogap.org/neogap/>

In another case, JPMorgan Chase refused to amend the terms of an existing borrower's refinancing agreement to permit a gas lease with BP. Chase's spokeswoman stated: “It's becoming wide-spread across the industry. Servicers and lenders are becoming more unwilling to approve a loan on these properties,” “At the end of the day, we may not even own the loan.”  
<http://www.vindy.com/news/2013/mar/10/banks-build-roadblocks-to-riches-from-dr/?print>

If a person cannot obtain a mortgage loan or keep a mortgage loan because of the risks associated with gas drilling operations, the house will be difficult to hold onto or sell. Where does that leave the homeowner? Either vulnerable to foreclosure, trapped in the home or forced to abandon it. If current trends continue, homeowners living in gas drilling regions, even those who elect not to sign a gas lease but who are compelled through compulsory integration or forced pooling to join a spacing unit; or other people living in close proximity to homeowners

with gas drilling on their property, may find themselves swept into the same net facing bankers and insurance underwriters electing not to loan or renew homeowners insurance because of the migrating risks, such as water contamination and seismic activity, associated unconventional gas drilling. What effect would this have on the home value of people who do not even support the gas drilling? Does the DRBC or a DRBC State open itself up to litigation for forcing a property owner against their will into a spacing unit if that homeowner is subsequently turned down for a mortgage loan or homeowners' insurance? How will the ripple effects of this affect the tax base?

New concerns regarding the ability to mortgage and insure a home are also arising out of the proliferation of retooled older pipelines and newer ones crisscrossing under residences throughout the Country. For example, on May 29, 2013 Exxon owned Pegasus pipeline burst open spilling at least hundreds of thousands of gallons of tar sands crude oil into the residential neighborhood of Mayflower, Arkansas requiring dozens of families to evacuate. In August, 2013 two unrelated pipeline explosions occurred in Illinois, one in Erie which required 80 families to temporarily evacuate their homes, another in Van Buren County which killed a man, destroyed his home and caused the temporary evacuation of 25 homes, affecting 35-40 people. What would such spills do to the Delaware River Basin and its residents? Time will tell whether mortgage lenders and insurance underwriters will revise their underwriting standards to exclude coverage for homes located in close proximity to high pressure pipelines.

<http://www.bloomberg.com/news/print/2013-09-02/decades-of-ruptures-from-defect-show-perils-of-old-pipe.html>

<http://www.arktimes.com/arkansas/ArticleArchives?tag=Pegasus%20pipeline%7C%7CExonMobil>

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Because of the connection to water contamination from the multi-phase drilling and fracking process and the vulnerability of homes to structural damage, what will happen to the property investment of families living across the Delaware River Basin if the DRBC elects to proceed with drilling in this water rich region? Where will these people go if their property is harmed? Who will buy the affected homes? For what price? Again, what will happen to the tax base?

The assertion by the oil and gas industry that unconventional shale gas drilling using current technology can be performed safely lacks credibility. Industry public disclosure documents, risk assessment by the insurance industry and regular reports of property damage and environmental impacts affecting homes across the nation support a contrary conclusion. Indeed, the growing reluctance of the mortgage and insurance industries to handle fracking affected properties, a reluctance driven by the long tradition of objective calculation of risk in both of these industries, presents an irrefutable answer to the claims of the oil and gas industry that unconventional gas drilling can be performed safely.

I urge the Delaware River Basin Commission not to endorse unconventional gas drilling in light of the expensive, uninsured risks it poses to homeowners and the potential it has for inflicting enormous economic losses, potentially in the many millions of dollars on homeowners and communities in the Delaware River Basin. The oil and gas industry asks that we consider the

benefits of unconventional shale gas drilling. I ask that you consider the costs, including the potential financial devastation of hundreds, if not thousands or more, of innocent homeowners and just say “No” to fracking. Thank you.