

HEALTH IMPACTS OF SHALE GAS EXTRACTION AND PRODUCTION

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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

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 and 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

--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/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), 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

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 .

--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 3rd 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.

REFERENCES:

HEALTH EFFECTS (general)

<http://www.who.int/about/definition/en/print.html>
<http://baywood.metapress.com/media/e05d2179tjdw5edyvm/contributions/6/6/1/4/661442p346j5387t.pdf>
http://www.damascuscitizens.org/Teitelbaum-Report_R1.pdf and
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Please see www.concernedhealthny.org and www.psehealthyenergy.org for updated peer-reviewed articles, reports and testimonies from health professionals.

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