From: donna dowell <dowelldirect@gmail.com>
Sent: Monday, November 13, 2017 4:27 PM
To: Sidney Hill
Subject: Oil and Gas Ordinance; Comments for County Commission meeting 11/16/17
Attachments: Sandoval Oil and Gas Ordinance; Public Comment, Donna Dowell 11-13-17.docx

Dear Mr. Hill,
Please forward my comments ***Health Effects and Risks of Oil and Gas Production and Sandoval County Oil and Gas Ordinance*** to each of the County Commissioners and submit to the official record for the 11/16/17 meeting. Please confirm that these comments have been formally entered into the public record for that meeting by responding to this email.
Respectfully yours,
Donna Dowell, CFNP

Health Effects and Risks of Oil and Gas Production and Sandoval County Oil and Gas Ordinance;

Submitted 11/13/17 to the public record for open meeting of the Sandoval County Commission 11/16/17

Donna Dowell, CFNP

Contents

On behalf of our county's public health, I urge the County Commission to adopt the strongest possible standards to reduce harmful emissions from the production wells, processing plants, transmission pipelines, and storage units within the oil and natural gas industry in Sandoval County. As a public health nurse, I am keenly aware of the harmful health effects of the air and water pollutants from oil and gas production. Research has shown that these pollutants can harm the circulatory, respiratory, nervous, and other essential and vital systems in the human body. These emissions can cause cancer, developmental disorders, and premature death. Allowing oil and gas development in the county will most certainly present new sources of hazardous pollutants that must be addressed in a county ordinance.

Environmental concerns surrounding drilling for gas are intense due to expansion of shale gas drilling operations across the US. In our own County controversy surrounding the impact of drilling on air and water quality has pitted industry and leaseholders against individuals and groups concerned with environmental protection and public health. As the County considers adoption of an oil and gas ordinance, the protection and promotion of public health and safety are the explicit duties of county leadership as stated in the COMPREHENSIVE ZONING ORDINANCE OF SANDOVAL COUNTY, NEW MEXICO;

> SECTION 2. PURPOSE
> The provisions of this Ordinance are designed to promote health and the general welfare of the County; to secure safety from fire, flood, and other dangers; to protect local water resources; to facilitate adequate provisions for transportation, water and wastewater systems, schools, parks and other community requirements; to conserve the value of property; and to provide for the compatible development of land and other natural resources in Sandoval County.

The language of an ordinance must address health and safety. This report is intended to inform decisions about what to include in an ordinance that allows for responsible oil and gas production but also protects our communities' health, safety, water and environment. The Sandoval County Oil and Gas Ordinance that currently being considered, also known as the "Stoddard Ordinance" is wholly negligent, leaving County residents at risk for associated grave health effects and environmental degradation. Alternatives, such as Citizen's Ordinance, with protections, have been proposed, though these alternatives have not to date been incorporated by the County Commission in a serious and comprehensive discussion regarding final ordinance language. This report will also point out specific ways in which an ordinance can allow for protections of health, safety, air and water, while maintaining reasonable requirements and conditions for responsible industry development.

Air and Water

Oil and gas operations have the potential to increase air and water pollution in communities located near operations. Every stage of operation from well construction to extraction, production, processing, flaring, transportation, and distribution can lead to air and water contamination. Emissions are vented to the atmosphere (intentionally or unintentionally) and impact air quality. In addition, hundreds of chemical additives are associated with the process of unconventional oil and natural gas production.

Concentrated chemical additives are delivered to the well site and stored until they are mixed with the base fluid and proppant and pumped down the oil and gas production well. While the overall concentration of additives in hydraulic fracturing fluids is generally small (typically 2% or less of the total volume of the injected fluid), the total volume of additives delivered to the well site can be large. Because there are millions of gallons of hydraulic fracturing fluid generally injected per well, thousands of gallons of additives can be stored on site and used during hydraulic fracturing. For example, a four million gallon fracturing operation would use from 80 to 330 tons of chemicals. Chemical additives are often stored in multiple, closed containers [typically 200 gallons (760 liters) to 375 gallons (1,420 liters) per container] and moved around the site in hoses and tubing. This equipment is designed to contain additives and blended hydraulic fracturing fluid, but spills occur. Changes in drinking water quality can

occur if spilled fluids reach groundwater or surface water resources[1]. Spills are not rare events (see discussion below on "Spills").

Deeper horizontal shale wells can use anywhere from 2 to 10 million gallons of water to fracture a single well. The extraction of so much water for fracking has raised concerns about the ecological impacts to aquatic resources, as well as dewatering of drinking water aquifers. Additionally, the large engines used in drilling and production processes burn fossil fuels and produce emissions that add to the air pollution burden affecting local communities. It has been estimated that the transportation of two to five million gallons of water (fresh or waste water) for a single well requires 1,400 truck trips. Thus, not only does water used for hydraulic fracturing deplete fresh water supplies and impact aquatic habitat, the transportation of so much water also creates localized air quality, safety and road repair issues.[2]

In a review of studies related to exposure pathways researchers evaluated the potential environmental public health impacts of shale gas development by addressing matters of toxicity, exposure pathways, air quality, and water quality. Researchers discussed evidence of potential environmental public health risks associated with shale gas development. Several studies cited suggest that shale gas development contributes to ambient air concentrations of pollutants known to be associated with increased risk of morbidity and mortality. Similarly, an increasing number of studies suggest that water contamination risks exist through a variety of environmental pathways, most notably during wastewater transport and disposal, and via poor zonal isolation of gases and fluids due to structural impairment of cement in gas wells. They concluded that despite a growing body of evidence, data gaps persist. Most important, authors stressed a need for more epidemiological studies to assess associations between risk factors, such as air and water pollution, and health outcomes among populations living in close proximity to shale gas operations.[3]

Respiratory Health Issues

Silicosis

As a longtime resident of Sandoval County and a nurse practitioner, I have lived and worked throughout the County for many years. Recently I worked in Shiprock for the Department of Labor with patients who have severe chronic irreversible respiratory illnesses from exposure to dust and chemicals as a result of having worked in the mining industry. They have a host of lung and immunologic problems that dramatically affect their ability to enjoy life. Simply, they cannot breathe, they suffer from silicosis.

For the past several years, there has been concern about the human health and environmental impacts of silica sand mining, processing, and transportation in oil and gas production.[4] Oil and gas like mining exposes workers to many of the same respiratory health risks. Hydraulic fracturing sand contains up to

[1] https://www.epa.gov/sites/production/files/2016-12/documents/hfdwa_executive_summary.pdf
[2] https://www.earthworksaction.org/issues/detail/hydraulic_fracturing_101
[3] Shonkoff SB, Hays J, Finkel ML. 2014. Environmental public health dimensions of shale and tight gas development. Environ Health Perspect 122:787-795.
[4] http://www.dnr.state.mn.us/silicasand/index.html

99% silica. Breathing silica can cause silicosis, a lung disease where lung tissue around trapped silica particles reacts, causing inflammation and scarring and reducing the lungs' ability to take in oxygen. Workers who breathe silica day after day are at great risk of developing silicosis. Silica can also cause lung cancer and has been linked to other diseases, such as tuberculosis, chronic obstructive pulmonary disease, and kidney and autoimmune disease.[5]

Exposure to silica contained in the sand used as the proppant during fracturing operations is pervasive. Over 10,000 tons of sand are mined, transported and processed for a single well. This "sand" is actually tiny pieces of quartz- silicon dioxide (SiO2) also known as silica.[6]

A NIOSH study of health hazards existing at oil and gas well drilling operations has revealed that several potential health hazards exist during well drilling and hydraulic fracturing operations. Overexposures up to twenty-nine times the OSHA PEL (permissible exposure limit) and up to 86 times the NIOSH REL (recommended exposure limit) were documented during sand moving operations.[7]

In addition, potential hazardous exposures to diesel particulate (stationary and mobile combustion engines), volatile organic chemicals in the form of naphthalene, benzene, toluene, ethyl benzene, and xylene (flow back operations and pit aeration), hydrogen sulfide, acid gases, aldehydes (water treatment chemicals) and metals such as lead were documented. Fatal work injuries in the private mining, quarrying, and oil and gas extraction industry increased 17 percent in 2014, and the fatal injury rate also increased to 14.1 per 100,000 FTE workers in 2014 from 12.4 per 100,000 FTE workers in 2013. Seventy-eight percent of the fatal work injuries in this sector were in oil and gas extraction industries in 2014.[8]

NIOSH's recent field studies show that workers may be exposed to dust with high levels of respirable crystalline silica (called "silica" in this Hazard Alert) during hydraulic fracturing. In cooperation with oil and gas industry partners, NIOSH collected 116 full shift air samples at 11 hydraulic fracturing sites in five states (Arkansas, Colorado, North Dakota, Pennsylvania and Texas) to determine the levels of worker exposure to silica at various jobs at the worksites. Many air samples showed silica levels for workers in and around the dust generation points above defined occupational exposure limits.[9]

Employers are required to take actions to reduce worker exposures if air samples show levels above OSHA's calculated Permissible Exposure Limit (PEL). The OSHA PEL is the legally enforceable regulatory limit. The NIOSH Recommended Exposure Limit (REL) is a non-mandatory, recommended occupational exposure limit. *However, because OSHA recognizes that many of its PELs are outdated and inadequate*

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[5] https://www.osha.gov/dts/hazardalerts/hydraulic_frac_hazard_alert.pdf.

[6] https://www.earthworksaction.org/issues/detail/frac_sand_mining#.U4I1RS8inBN

[7] NIOSH Oil and Gas Extraction Safety and Health Research, May 29, 2012, NIOSH Field Effort to Assess Chemical Exposures in Oil and Gas Workers: Health Hazards in Hydraulic Fracturing.

[8] **https://www.osha.gov/dep/leps/RegionIII/reg3_fy2017_2017-01_oilgas.pdf**

[9] **https://www.osha.gov/dts/hazardalerts/hydraulic_frac_hazard_alert.pdf**

measures of worker safety, both OSHA and NIOSH recommend that employers take actions to keep worker exposures below the NIOSH REL.[9]

Asthma

Workers are not alone in their exposure to respiratory health risks. A 2016 analysis showed that by 2025 America's children will experience 750,000 asthma attacks each summer that will be **directly attributable to the oil and gas industry.** The report was the first to quantify the effects of smog caused by oil and gas production. The authors particularly looked at methane and volatile organic compounds (VOCs). VOCs such as gasoline, benzene and formaldehyde, are particularly concerning as they are heavier than air, allowing them to pool in low-lying areas, where people live and breathe. Unfortunately contaminated air and water know no boundaries. Many VOCs are known to cause cancer. In Weld County, Colorado, asthma rates there increased 16 percent between 2007 and 2013. During that time natural gas production in the county more than doubled, and oil production increased six-fold.[10]

The first peer-reviewed study to directly quantify how emissions from oil and gas activities influence summertime ozone pollution in the Colorado Front Range confirms that chemical vapors from oil and gas activities are a significant contributor to the region's chronic ozone problem. By combining nearly 50,000, high-precision measurements of VOCs in Colorado's Front Range with an equally detailed model, researchers were able to parse out the role of oil and gas. They found that VOCs from oil and gas are indeed influencing ozone pollution. Ozone pollution can harm people's lungs and damage crops and is produced when sunlight sparks reactions between volatile organic compounds (VOCs) and nitrogen oxides (NOx).[11]

People most at risk from breathing air containing ozone include people with asthma, children, older adults, and people who are active outdoors, especially outdoor workers. In addition, people with certain genetic characteristics, and people with reduced intake of certain nutrients, such as vitamins C and E, are at greater risk from ozone exposure. Children are at greatest risk from exposure to ozone because their lungs are still developing and they are more likely to be active outdoors when ozone levels are high, which increases their exposure. Children are also more likely than adults to have asthma. Ozone can cause the muscles in the airways to constrict, trapping air in the alveoli. This leads to wheezing and shortness of breath. Ozone can:

- Make it more difficult to breathe deeply and vigorously.
- Cause shortness of breath, and pain when taking a deep breath.
- Cause coughing and sore or scratchy throat.
- Inflame and damage the airways.
- Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.

[10] https://thinkprogress.org/asthma-attacks-from-oil-gas-industry-8284433fd5c5/

[11] https://phys.org/news/2016-08-quantify-impact-oil-gas-emissions.html#jCp

- Increase the frequency of asthma attacks.
- Make the lungs more susceptible to infection.
- Continue to damage the lungs even when the symptoms have disappeared.
- Cause chronic obstructive pulmonary disease (COPD).

These effects have been found even in healthy people, but can be more serious in people with lung diseases such as asthma. They may lead to increased school absences, medication use, visits to doctors and emergency rooms, and hospital admissions.

Long-term exposure to ozone is linked to aggravation of asthma, and is likely to be one of many causes of asthma development. Long-term exposures to higher concentrations of ozone may also be linked to permanent lung damage, such as abnormal lung development in children.

Recent studies consistently report associations between short-term ozone exposures and total non-accidental mortality, which includes deaths from respiratory causes. Studies suggest that long-term exposure to ozone also may increase the risk of death from respiratory causes, but the evidence is not as strong as the evidence for short-term exposure.[12]

Responsible oil and gas industry interests will want to implement controls in the workplace, for example the NIOSH MiniBaghouse Retrofit Assembly, which is designed to reduce respirable silica emissions from sand movers during hydraulic fracturing.[13]

In 2014, the United States led the world in oil and gas production, with fifteen million Americans living within one mile of an oil or gas well. [14] A Yale study showed that living within a half mile (2,640 feet) from oil and gas production is correlated with several health impacts, including respiratory illness.[15]

In New Mexico, San Juan and McKinley counties in the NW and SE areas of the State respectively, have some of the highest numbers of children and elders suffering from asthma. Maps of oil and gas VOC emissions in these two areas of the State (Appendix A) and asthma attacks in children (Appendix B), demonstrate a correlation between asthma rates and VOC emissions from oil and gas production.

New Mexico's two biggest energy-producing regions are two of the most polluted in the nation when it comes to methane emissions, according to a study. Both the San Juan Basin and the Permian Basin rank

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[12] **https://www.epa.gov/ozone-pollution/health-effects-ozone-pollution**

[13] **https://www.cdc.gov/niosh/docs/2016-129/pdfs/2016-129.pdf, rated sound wall panels typically reduce equipment noise levels 15 to 22 dBA**

[14] **https://endocrinedisruption.org/audio-and-video/oil-and-gas-publications.**

[15] http://www.nhregister.com/colleges/article/Yale-study-Health-problems-found-in-people-11369602.php

as the third and fourth most methane polluted regions in the country, according to the Washington D.C.-based progressive think tank Center for American Progress "The Who's Who of Methane Pollution" report. The report is based on 2014 data from the federal Environmental Protection Agency. The San Juan Basin emits the most methane per well in the country. Methane emissions are commonly viewed as a greenhouse gas more harmful than carbon dioxide and the report underlines this point and pushes the federal government for strong regulations limiting them. They can cause respiratory problems and loss of oxygen when people are exposed to them.[16]

In another study, researchers asked the question "Is there an association between unconventional natural gas development (UNGD) and asthma exacerbations? Findings in this study of 35,508 patients with asthma, those in the highest quartile of residential UNGD activity had significantly higher odds of 3 types of asthma exacerbations (new oral corticosteroid medication orders, emergency department visits, and hospitalizations) than those in the lowest quartile. Meaning UNGD activity near patient residences was associated with increased odds of mild, moderate, and severe asthma exacerbations.[17]

Endocrine Disrupting Chemicals

A recently studied phenomenon termed endocrine disruption exchange, endocrine meaning glandular or hormonal, exposes ample evidence for disruption of the estrogen, androgen, and progesterone receptors by oil and gas chemicals, which provides a rationale for how exposure to oil and gas activities may increase health risks. While new technologies have dramatically increased domestic oil and natural gas production, they have also raised concerns for the potential contamination of local water supplies with the approximately 1,000 chemicals used throughout the process, including many known or suspected endocrine-disrupting chemicals. Chemical compounds used by drilling companies disrupt hormone function and can have substantial and permanent impacts on health.[18] Human exposure to fracking chemicals can occur by ingesting chemicals that have spilled and entered drinking water sources, through direct skin contact with the chemicals or wastes (e.g., by workers, spill responders or health care professionals), or by breathing in vapors from flow back wastes stored in pits or tanks.

An exploratory study was designed to assess air quality in a rural western Colorado area where residences and gas wells co-exist. Sampling was conducted before, during, and after drilling and hydraulic fracturing of a new natural gas well pad. Weekly air sampling for 1 year revealed that the number of non-methane hydrocarbons (NMHCs) and their concentrations were highest during the initial drilling phase and did not increase during hydraulic fracturing in this closed-loop system. Methylene chloride, a toxic solvent not reported in products used in drilling or hydraulic fracturing, was detected 73% of the time, several times in high concentrations. A literature search conducted by the researchers of the health effects of the NMHCs revealed that many had multiple health effects, including 30 that

[16] http://nmpoliticalreport.com/53196/report-two-nm-regions-among-top-five-for-methane-emissions/
[17] https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2534153?resultclick=1

[18] https://endocrinedisruption and.org/audio- -video/chemical-health-effects-spreadsheets

affect the endocrine system, which is susceptible to chemical impacts at very low concentrations, far less than government safety standards. Selected polycyclic aromatic hydrocarbons (PAHs) were at concentrations greater than those at which prenatally exposed children in urban studies had lower developmental and IQ scores. The human and environmental health impacts of the NMHCs, which are ozone precursors, should be examined further given that the natural gas industry is now operating in close proximity to human residences and public lands.[19]

A systematic review of 45 studies indicate there is moderate evidence for an increased risk of preterm birth, miscarriage, birth defects, decreased semen quality, and prostate cancer. The results from this systematic review suggest there is a negative impact on human reproduction from exposure to oil and gas activities. Many of the 45 studies reviewed identified potential human health effects. Most of these studies focused on conventional oil and gas activities. Few studies have been conducted to evaluate the impact of unconventional oil and gas operations on human health. The impact of unconventional oil and gas activities may be greater than that of conventional activity, given that unconventional activities employ many of the same approaches and use dozens of known endocrine-disrupting chemicals in hydraulic fracturing

Currently, 95% of end disposal of hydraulic fracturing wastewater from unconventional oil and gas operations in the US occurs via injection wells. Key data gaps exist in understanding the potential impact of underground injection on surface water quality and environmental health. The goal of a West Virginia study was to assess endocrine disrupting activity in surface water at an injection well disposal site. Water samples were collected from a background site in the area and upstream, on, and downstream of the disposal facility. Compared to reference water extracts upstream and distal to the disposal well, samples collected adjacent and downstream exhibited considerably higher antagonist activity for the estrogen, androgen, progesterone, glucocorticoid and thyroid hormone receptors. Concurrent analyses by partner laboratories (published separately) describe the analytical and geochemical profiling of the water, elevated conductivity as well as high sodium, chloride, strontium, and barium concentrations indicate impacts due to handling of unconventional oil and gas wastewater. Notably, antagonist activities in downstream samples were at equivalent authentic standard concentrations known to disrupt reproduction and/or development in aquatic animals. Given the widespread use of injection wells for end-disposal of hydraulic fracturing wastewater, these data raise concerns for human and animal health nearby.[20]

Because of the potential for long-term effects of even low doses of environmental toxicants and the cumulative impact of exposures of multiple chemicals by multiple routes of exposure, a longitudinal study of 21 cases of animals and humans affected by nearby drilling operations from 5 states, with a

[19] Colborn T, Schultz K, Herrick L, Kwiatkowski C. 2014. An exploratory study of air quality near natural gas operations. Hum Ecol Risk Assess 20(1):86-105.

[20] Kassotis CD, Iwanowicz LR, Akob DM, Cozzarelli IM, Mumford AC, Orem WH, Nagel SC. 2016. Endocrine disrupting activities of surface water associated with a West Virginia oil and gas industry wastewater disposal site. Sci Total Environ 557-558:901-910.

follow-up period of 25 months was under study. More than half of all exposures were related to drilling and hydraulic fracturing operations. More than a third of all exposures were associated with wastewater, processing and production operations, these exposures increased slightly over time. Health impacts decreased for families and animals moving from intensively drilled areas or remaining in areas where drilling activity decreased. In cases of families remaining in the same area and for which drilling activity either remained the same or increased, no change in health impacts was observed. Over the course of the study, the distribution of symptoms was unchanged for humans and companion animals, but in food animals, reproductive problems decreased and both respiratory and growth problems increased.[21]

Over the past ten years, unconventional gas and oil drilling (UGOD) has markedly expanded in the United States. Despite substantial increases in well drilling, the health consequences of UGOD toxicant exposure remain unclear. A study that examined an association between wells and healthcare use by zip code from 2007 to 2011 in Pennsylvania demonstrated that patient discharge databases from the Pennsylvania Healthcare Cost Containment Council were correlated with active wells by zip code in three counties in Pennsylvania.

For overall inpatient prevalence rates and 25 specific medical categories, the association of inpatient prevalence rates with number of wells per zip code and, separately, with wells per km2 (separated into quantiles and defined as well density) were estimated. Cardiology inpatient prevalence rates were significantly associated with number of wells per zip code ($p<0.00096$) and wells per km2 ($p<0.00096$) while neurology inpatient prevalence rates were significantly associated with wells per km2 ($p<0.00096$).

Furthermore, evidence also supported an association between well density and inpatient prevalence rates for the medical categories of dermatology, neurology, oncology, and urology. These data suggest that UGOD wells, which dramatically increased in the past decade, were associated with increased inpatient prevalence rates within specific medical categories in Pennsylvania. Further studies are necessary to address healthcare costs of UGOD and determine whether specific toxicants or combinations are associated with organ-specific responses.[22]

In a review of 1000 studies that looked at the strength of epidemiological evidence in scientific reporting of environmental hazards from unconventional natural gas development activities associated with adverse human health outcome, researchers found that the vast majority of studies focused on short-term rather than long-term impacts, in other words very few studies examined health impacts with

[21]Bamberger M, Oswald RE. 2015. Long-term impacts of unconventional drilling operations on human and animal health. J Environ Sci Health Part A 50(5):447-459.

[22] Jemielita T, Gerton GL, Neidell M, Chillrud S, Yan B, Stute M, Howarth M, Saberi P, Fausti N, Penning TM, et al. 2015. Unconventional gas and oil drilling is associated with increased hospital utilization rates. PloS One 10(7):e0131093.

longer latencies such as cancer or developmental outcomes. Authors stated that this is a clear gap in the scientific knowledge that requires urgent attention. [23]

Much of the scientific literature presented here provides evidence that exposure to chemicals associated with UOG operations can result in adverse health and developmental effects in humans. Volatile organic compounds (VOCs) [including benzene, toluene, ethyl benzene, and xylene (BTEX) and formaldehyde] and heavy metals (including arsenic, cadmium and lead) are just a few of the known contributors to reduced air and water quality that pose a threat to human developmental and reproductive health. The developing fetus is particularly sensitive to environmental factors, which include air and water pollution. Research shows that there are critical windows of vulnerability during prenatal and early postnatal development, during which chemical exposures can cause potentially permanent damage to the growing embryo and fetus.[24]

Many of the air and water pollutants found near oil and gas operation sites are recognized as being developmental and reproductive toxicants, therefore there is a compelling need to increase our knowledge of the potential health consequences from these chemicals through rapid and thorough health research investigation. A seminal study by Colborn et al., published in 2010, summarized health effect information for 353 chemicals used to drill and fracture natural gas wells in the United States.

Health effects were broken into 12 categories: skin, eye and sensory organ, respiratory, gastrointestinal and liver, brain and nervous system, immune, kidney, cardiovascular and blood, cancer, mutagenic, endocrine disruption, other, and ecological effects. The chart (see Appendix C) illustrates the possible health effects associated with the 353 natural gas-related chemicals for which Colborn and her co-authors were able to gather health-effects data. Colborn's paper provides a list of 71 particularly nasty drilling and fracturing chemicals, i.e., those that are associated with 10 or more health effects. Approximately 40--50% could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37% could affect the endocrine system; and 25% could cause cancer and mutations.[25]

[23] Werner AK, Vink S, Watt K, Jagals P. 2015. Environmental health impacts of unconventional natural gas development: a review of the current strength of evidence. Sci Total Environ 505:1127-1141.

[24] (Webb E, Bushkin-Bedient S, Cheng A, Kassotis CD, Balise V, Nagel SC. 2014. Developmental and reproductive effects of chemicals associated with unconventional oil and natural gas operations. Rev Environ Health 29(4):307-318.)

[25]Human and Ecological Risk Assessment, 17: 1039-1056, 2011 Copyright © Taylor & Francis Group, ll.C
ISSN: 1080-7039 print / 1549-7860 online

Our Children, Our Future

The discussion of risk to children needs to include a better understanding of the current evidence about the risk to their health.[26] Children face quite different risks from air pollutants than adults. Their lungs and their alveoli are not fully grown until children become adults. Biological defenses that help adults fight off infections are still developing in young bodies.[27] They are outside for longer periods and are usually more active when outdoors. Consequently, they inhale more polluted outdoor air than adults typically do. Clearly more research is needed but, until we know more it is critical to protect our air and water for our children and for our future. An ample margin of safety is necessary to protect children who inherently display greater sensitivity to environmental carcinogens then do adults.

Noise

Literature indicates that oil and gas activities produce noise at levels that may increase the risk of adverse health outcomes, including; annoyance, sleep disturbance, and cardiovascular disease. More studies that investigate the relationships between noise exposure and human health risks from unconventional oil and gas development are warranted. Finally, policies and mitigation techniques that limit human exposure to noise from oil and gas operations should be considered to reduce health risks.[28]

Responsible oil and gas industry interests will want to implement controls in the workplace, such as noise mitigation systems, for example rated sound wall panels that typically reduce equipment noise levels by 15 to 22 dBA.[29]

Spills

Each year, 2 to 16 percent of hydraulically fractured oil and gas wells spill hydrocarbons, chemical-laden water, hydraulic fracturing fluids and other substances, according to a new study. The analysis, which appears Feb. 21 in *Environmental Science & Technology*, identified 6,648 spills reported across Colorado, New Mexico, North Dakota and Pennsylvania during a 10-year period. Fifty percent of spills identified in the *Environmental Science & Technology* article were related to storage and moving fluids via pipelines. Analyses like this one are so important, to define and mitigate risk to water supplies and human health.[30]

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[26] Human and Ecological Risk Assessment, 17:1039-1056, 2011 Copyright © Taylor & Francis Group, ll.C ISSN: 1080-7039 print / 1549-7860 online

[27] https://ehp.niehs.nih.gov/wp-content/uploads/118/8/ehp.1001971.pdf

[28] https://www.psehealthyenergy.org/our-work/publications/archive/public-health-implications-of-environmental-noise-associated-with-unconventional-oil-and-gas-development/

[29] http://www.drillingnoisecontrol.com/temp_sound_walls.html

[30] https://phys.org/news/2017-02-fracking-states.html#jCp.

Wastewaters from oil and gas development pose largely unknown risks to environmental resources. In January 2015, 11.4 M L (million liters) of wastewater (300 g/L TDS) from oil production in the Williston Basin was reported to have leaked from a pipeline, spilling into Blacktail Creek, North Dakota. Geochemical and biological samples were collected in February and June 2015 to identify geochemical signatures of spilled wastewaters as well as biological responses along a 44-km river reach. February water samples had elevated chloride (1030 mg/L) and bromide (7.8 mg/L) downstream from the spill, compared to upstream levels (11 mg/L and <, 0.4 mg/L, respectively). Lithium (0.25 mg/L), boron (1.75 mg/L) and strontium (7.1 mg/L) were present downstream at 5–10 times upstream concentrations.

Light hydrocarbon measurements indicated a persistent thermogenic source of methane in the stream. Semi-volatile hydrocarbons indicative of oil were not detected in filtered samples but low levels, including tetramethylbenzenes and di-methylnaphthalenes, were detected in unfiltered water samples downstream from the spill.

Labile sediment-bound barium and strontium concentrations (June 2015) were higher downstream from the Spill Site. Radium activities in sediment downstream from the Spill Site were up to 15 times the upstream activities and, combined with Sr isotope ratios, suggest contributions from the pipeline fluid and support the conclusion that elevated concentrations in Blacktail Creek water are from the leaking pipeline.

Results from June 2015 demonstrate the persistence of wastewater effects in Blacktail Creek several months after remediation efforts started. Aquatic health effects were observed in June 2015, fish bioassays showed only 2.5% survival at 7.1 km downstream from the spill compared to 89% at the upstream reference site. Additional potential biological impacts were indicated by estrogenic inhibition in downstream waters. Our findings demonstrate that environmental signatures from wastewater spills are persistent and create the potential for long-term environmental health effects.[31]

Monitoring

In order to protect the public's health we must know what chemicals we are dealing with in our environment. The oil and gas industry commonly claims proprietary privilege, withholding important information about chemicals used throughout the production process, chemicals that gravely impact human and environmental health. As a nurse I record every medication administered to a patient, the scientific name of the drug, date, time, dose, the route, the therapeutic effectiveness, and the untoward effects. I educate the patient about the benefits as well as the risks to taking a drug. Why do we not afford our community the same ethics that medical practice affords individuals? One important point made by a physician is that if a physician does not know what chemicals a patient may be exposed to it is hard to diagnose and know what treatment should be recommended.

[31] Balise VD, Meng C-X, Cornelius-Green JN, Kassotis CD, Kennedy R, Nagel SC. 2016. Systematic review of the association between oil and natural gas extraction processes and human reproduction. Fertil Steril 106(4):795-819.

We must incorporate independent and periodic monitoring of air and water for chemical contamination on all oil and gas operations in the State. Such measures are included in the Citizen's ordinance, but not the Stoddard. There are no other State or Federal entities that require air and water monitoring. It is within the legal and ethical domain of the local municipalities and governing bodies to require such monitoring of air and water.[32]

Protections

Many of these risks can be mitigated by a local ordinance with protections for workers, residents and environment. Care must be taken to monitor local air quality and ground water quality for each well. Every step in the preparation of every well has the potential to influence the health of local residents.

- Require periodic air and water monitoring by third party labs, paid for by the industry.
- Bring modern systems into the measures and monitoring tools to detect leaks or fugitive emissions.
- Require 98% control of volatile organic compounds (VOC) and hazardous air pollutants from storage vessels, such requirements have been adopted in WY, CA, CO.
- Require that well cellars, sumps, and pools of oil be covered to prevent VOC emissions.
- Target methane emission reductions specifically and help producers save valuable energy that is being lost, reduce methane emissions and improve revenues for the state.
- Given studies that place greater risk for respiratory illness at one-half mile from production sites (e.g. Yale study mentioned above), the presence of vulnerable populations within our communities (children, elderly, those with cardiac and respiratory condition), and a judicious margin of safety, require setbacks of 2,640 feet from schools, parks, and residential areas.
- Require that the threshold of a "major source" be based on evaluations of both the emissions in a single source within the facility and a facility-wide assessment of all smaller sources. If more than one source would not meet the individual requirements, then the total emissions from those sources in a facility should be evaluated to determine if they collectively meet the threshold. There is concern about the danger that a facility that has multiple "non-major" sources all of which fall just below the threshold for classification as a major source could avoid having to comply with the requirements.
- Discontinue the use of open evaporation pits, water ponds and land farms. Land farming is used to treat oily petroleum industry wastes by periodic tillage of a mixture of waste and soil to increase aeration of the waste-soil mixture to enhance aerobic biodegradation of hydrocarbons, off-gassing many of the VOCs contained in the waste into the atmosphere. As well, water ponds of "produced water" used in the extraction process emit large amounts of VOC.
- Account for all chemicals used in the process. In light of the potential for environmental release of oil and gas chemicals that can disrupt hormone receptor systems, methods for assessing

[32] file:///C:/Users/Admin/Documents/Politico/oil%20and%20gas/Colborn_2011_Natural_Gas_from_a_public_health_perspective.pdf

complex hormonally active environmental mixtures is essential to explain reported adverse health trends as well as inform environmental impact assessments and monitoring programs.[33]

- As state in the Citizen's Ordinance, the County must be given explicit authority to enforce compliance to ordinance protections by issuing closures of operations for operators in violation.

Access to Health Care

Currently 20% of County residents are without health insurance. The current proposed national cuts on health care coupled with the associated health risks of oil and gas, compound the health risks for residents and workers in our County. Oil and gas operations without the safeguards of a durable ordinance will affect the health of many county residents especially those with heart and respiratory issues. We know there are many risks to health as a result of oil and gas production. Each source of risk requires regulations and enforcements needed to mitigate those risks to the public. This Board can use scientific and technical information that will serve you, the decision makers, in forming policy. Such inquiry is not an option but a responsibility of the Board.

Public Discourse

This communication distills some of the research evidence on key health concerns to assist local leadership and health professionals to be better prepared to engage in decision-making and address the risks and challenges associated with the oil and gas industry. As suggested by Commissioner Holden-Rhodes, the formation of a task force including county residents might best inform the Commission about what issues need to be addressed in forming policy. Discussions with communities and experts, supported by the expanding research should include increasing health concerns in six key areas. These are absence of a safe solution to the toxic wastewater management problems, air pollution, land and water pollution, bodily health risks, fugitive methane emissions and lack of proven regulatory regimes. Our rural residents in potentially affected areas should be supported to access and interpret the best current evidence regarding the multiple health concerns associated with oil and gas mining. Despite significant health concerns, public health knowledge and growing evidence are being overlooked in decision-making. This knowledge should be part of wider discourse and decision-making processes driving local economic development and energy choices.

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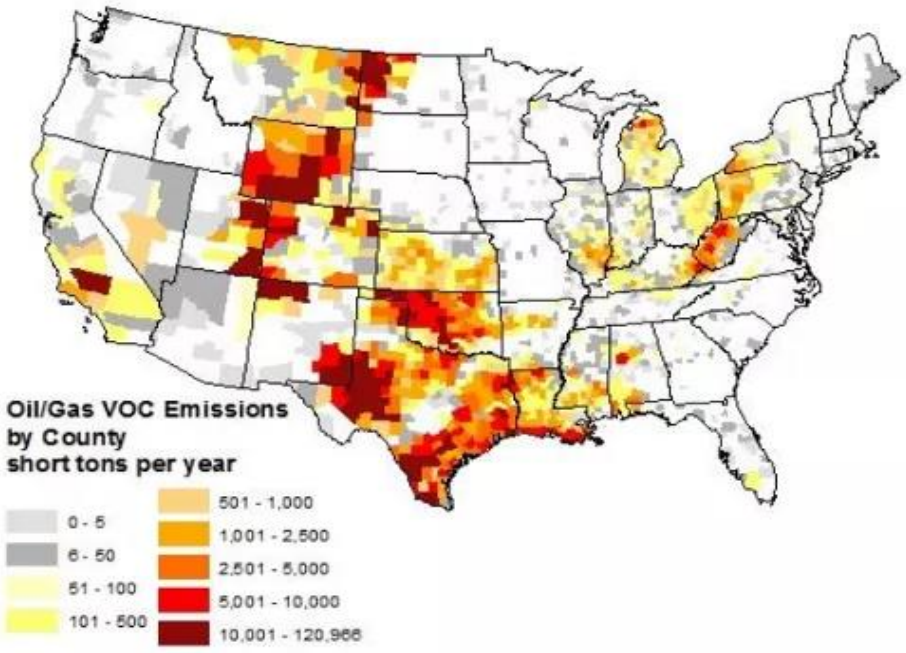
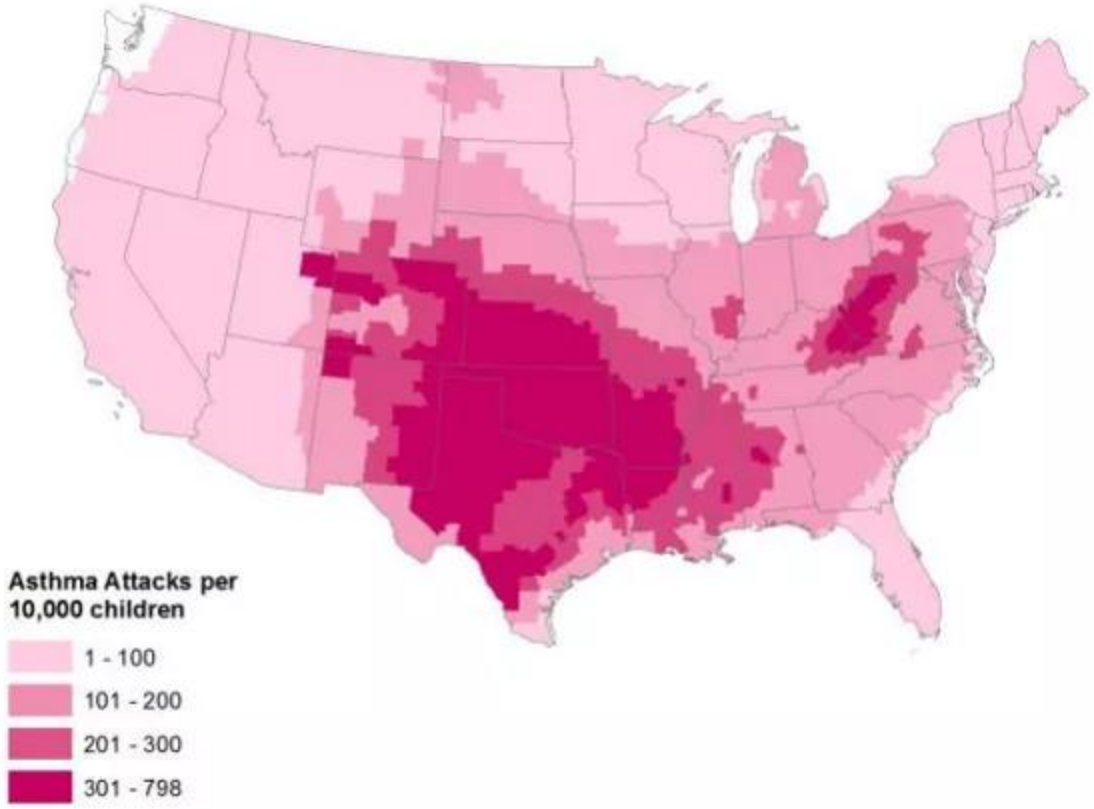
33 https://www.biologicaldiversity.org/campaigns/fracking/pdfs/Colborn_2011_Natural_Gas_from_a_public_health_perspective.pdf

Appendix A

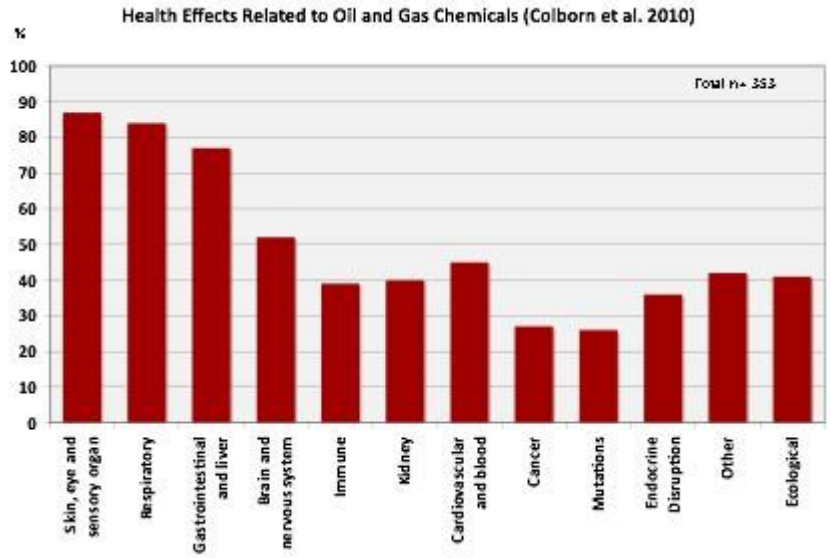


The EPA projects that oil and gas facilities will emit approximately 3.5 million tons of smog-forming volatile organic compounds in 2025.

Appendix B


Asthma Attacks per
10,000 children
1 - 100
101 - 200
201 - 300
301 - 798

Appendix C



Natural gas drilling and hydraulic fracturing chemicals with 10 or more health effects

- 2,2',2"-Nitrilotriethanol
- 2-Ethylhexanol
- 5-Chloro-2-methyl-4-isothiazolin-3-one
- Acetic acid
- Acrolein
- Acrylamide (2-propenamide)
- Acrylic acid
- Ammonia
- Ammonium chloride
- Ammonium nitrate
- Aniline
- Benzyl chloride
- Boric acid
- Cadmium
- Calcium hypochlorite
- Chlorine
- Chlorine dioxide
- Dibromoacetonitrile 1
- Ethylene glycol
- Ethylene glycol monobutyl ether (2-BE)
- Ethylene oxide
- Ferrous sulfate
- Formaldehyde
- Formic acid
- Fuel oil #2
- Glutaraldehyde
- Glyoxal
- Hydrodesulfurized kerosene
- Hydrogen sulfide
- Iron
- Isobutyl alcohol (2-methyl-1-propanol)
- Isopropanol (propan-2-ol)
- Kerosene
- Light naphthenic distillates, hydrotreated
- Naphtha, petroleum medium aliphatic
- Naphthalene
- Natural gas condensates
- Nickel sulfate
- Paraformaldehyde
- Petroleum distillate naptha
- Petroleum distillate/ naphtha
- Phosphonium, tetrakis(hydroxymethyl)-sulfate
- Propane-1,2-diol
- Sodium bromate
- Sodium chlorite (chlorous acid, sodium salt)
- Sodium hypochlorite
- Sodium nitrate
- Sodium nitrite
- Sodium sulfite
- Styrene
- Sulfur dioxide

- Diesel 2
- Diethanolamine
- Diethylenetriamine
- Dimethyl formamide
- Epidian
- Ethanol (acetylenic alcohol)
- Ethyl mercaptan
- Ethylbenzene
- Mercaptoacidic acid
- Methanol
- Methylene bis(thiocyanate)
- Monoethanolamine
- NaHCO3
- Sulfuric acid
- Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (Dazomet)
- Titanium dioxide
- Tributyl phosphate
- Triethylene glycol
- Urea
- Xylene[34]

[34] https://www.biologicaldiversity.org/campaigns/fracking/pdfs/Colborn_2011_Natural_Gas_from_a_public_health_perspective.pdf