

**EPA Science Advisory Board
Hydraulic Fracturing Research Advisory Panel
Public Teleconference February 1, 2016
Oral Statement of Michelle Bamberger**

From: Michelle Bamberger
Sent: Monday, January 25, 2016 1:22 PM
To: Hanlon, Edward <Hanlon.Edward@epa.gov>
Subject: Re: EPA SAB Review Draft Report Teleconference 02/01/16

Mr. Hanlon,

Attached please find my written comments and my slide presentation. I am also attaching written comments made by me and Prof. Robert Oswald soon after the EPA report was released. Also attached are the two case report studies that I refer to in my comments and the presentation.

Two attachments for the Panel's consideration are not included within this posting, due to copyright protection requirements. These two attachments are:

- 1) Michelle Bamberger & Robert E. Oswald. 2012. IMPACTS OF GAS DRILLING ON HUMAN AND ANIMAL HEALTH. Published in NEW SOLUTIONS, Vol. 22(1) 51-77, 2012; published in 2012 by Baywood Publishing Co., Inc.
- 2) Michelle Bamberger & Robert E. Oswald (2015) Long-term impacts of unconventional drilling operations on human and animal health, Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances and Environmental Engineering, 50:5, 447-459, DOI: 10.1080/10934529.2015.992655

Please let me know if there is anything else I need to send. Regarding the slide presentation, will I receive instructions on presenting the slides when I call in on Feb. 1?

Thank you,
Michelle

Comments on EPA Draft Report: Assessment of Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Michelle Bamberger, MS, DVM

Feb. 1, 2016

I am pleased to submit my comments on this draft report to the SAB. I am a veterinarian, researcher and author. I have been studying the impacts of hydraulic fracturing for oil & gas since 2009. My comments are based on case report studies^{1, 2} attached as a part of these comments. I am also submitting comments I made with Robert Oswald soon after this report was released. These comments may also be found at <http://www.beaconbroadside.com/broadside/2015/07/epas-study-of-fracking-media-hype-and-reality.html>.

For the first study¹, we collected information on industrial operations, environmental test results and health records from 24 animal owners in six states (Colorado, Louisiana, New York, Ohio, Pennsylvania, Texas). This information was used to methodically describe how exposures may occur and to report health effects of those affected by gas drilling. We found that water quality and quantity changes were often reported after drilling and hydraulic fracturing. The most common exposure was to affected water wells and/or springs (17/24); the next most common exposure was to affected ponds or creeks (8/24). We used longitudinal retrospective controls (health was compared before and after drilling began) and spatial controls (farmers split cattle herds into two or more groups and grazed the cattle on separate pastures). In each case where spatial controls occurred, one pasture or water supply was inadvertently contaminated and the remainder of the herd was not exposed. In each of these cases, exposed cattle suffered significantly greater health impacts than the unexposed. Health impacts were seen in people and animals in all categories. In people, upper respiratory symptoms and burning of the eyes were the most commonly reported. In companion and food animals, reproductive problems were most common.

In the second study², we compared the level of industrial activity at the time of the first interview to the time of the second interview (increased, decreased, stayed the same) with the follow-up period averaging 25 months. We found that health impacts dropped for families and animals moving out of intensively drilled areas or remaining in areas where drilling activity decreased. Since this study was completed, more families have moved away due to health issues. We also found that the distribution of symptoms over time was unchanged for humans and companion animals, but was significantly changed for food animals. Reports of reproductive failure fell (likely due to remediation and moving cattle off contaminated pastures or away from contaminated drinking sources), while respiratory issues and stunted growth were reported more often. Two epidemiological studies^{3, 4} of human births are consistent with the stunted growth seen here in food animals. Both show a decrease in birth weight and low APGAR scores were associated with proximity to shale gas operations. A recent study⁵ evaluating health risks from

chemicals found in hydraulic fracturing fluids and/or wastewater notes the potential of these chemicals to cause reproductive and/or developmental toxicity and supports the reproductive and developmental impacts we reported in food animals.

Drinking water resources (well water, ponds, creeks, pasture run off) used by food animals are not assessed in this draft EPA report and should be included for many reasons. Hydraulic fracturing for oil and gas mainly occurs in agricultural areas, often adjacent to grazing cattle. Due to blowouts, casing failures, leaky valves or dumping, food animals may become inadvertently exposed to hydraulic fracturing fluids, wastewater, or contaminated drinking water, and experience associated health impacts. Only one herd has been quarantined, yet many herds are potentially exposed on a daily basis. This raises food safety concerns because no monitoring of food products or tracking of animals is being done in areas of intensive extraction.

References

1. Bamberger, M and Oswald, R.E. (2012) Impacts of gas drilling on human and animal health. *New Solutions*, 22 (1), 51-77.
2. Bamberger, M. and Oswald, R.E. (2015) Long-term impacts of unconventional drilling operations on human and animal health. *Journal of Environmental Science and Health Part A* 50, 447-459.
3. McKenzie, L. et al. (2014) Birth Defects and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, *Environ Health Perspect*, 122(4): 412-417.
4. Hill, E. (2012) Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, <http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf>
5. Elliott, E.G. et al. (6 January 2016) A systematic evaluation of chemicals in hydraulic-fracturing fluids and wastewater for reproductive and developmental toxicity, *Journal of Exposure Science and Environmental Epidemiology*, doi:10.1038/jes.2015.81.

The EPA recently released a review draft of its long awaited study of hydraulic fracturing in the United States entitled: "Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources." This report, which totaled almost 1000 pages, was undoubtedly read by very few people, but the news coverage was astounding. Oklahoma's senator Jim Inhofe stated in a press release: "EPA's report on hydraulic fracturing confirms what we have known for over 60 years when the process began in Duncan, Oklahoma—hydraulic fracturing is safe..." Erik Milito of the American Petroleum Institute said "After more than five years and millions of dollars, the evidence gathered by EPA confirms what the agency has already acknowledged and what the oil and gas industry has known: hydraulic fracturing is being done safely under the strong environmental stewardship of state regulators and industry-best practices..." But is that the message from the document itself? Tom Burke, the deputy assistant administrator of the EPA's office of research, explained the impact of the document: "It's not a question of safe or unsafe" but rather "how do we best reduce vulnerabilities so we can best protect our water and water resources?"

If we accept Tom Burke's explanation, how did so many news outlets get the story so wrong? The document itself states: "We did not find evidence that these mechanisms have led to widespread, systematic impacts on drinking water resources in the United States." This was the quote that was taken out of context and drove the breathless news coverage. A very different picture emerges if one actually takes the time to read the document. The report acknowledges that identified cases of water contamination are small relative to the number of wells drilled and hydraulically fractured. But the important point is that the report also notes that this may well be an underestimation due to the lack of predrilling testing, other sources of chemicals that complicate identifying the source of contamination, short duration of studies, and inaccessible information. Since most of this information was gleaned from published studies rather than new information generated by the EPA, the actual conclusions of the EPA are what most of us that have studied this issue already knew. That is, we cannot state for certain that widespread, systematic impacts on drinking water resources occur due to unconventional fossil fuel extraction mainly because, in the words of the EPA, "data limitations preclude a determination of the frequency of impacts with any certainty." Ironically, the day after the release of the EPA report, Mark Nechodom, the director of the California Department of Conservation, resigned due to a scandal involving the direct injection of wastewater from oil extraction into Central Valley aquifers. Even more recently, a paper was published in *Environmental Science & Technology* that demonstrated widespread contamination of drinking water wells in the Barnett Shale region of Texas by BTEX (benzene, toluene, ethyl benzene, and xylene) and various chlorinated compounds (Hildebrand, *et al.*, DOI: 10.1021/acs.est.5b01526, June 16, 2015). While the link between widespread drilling activities could not be definitively proven, historical evidence suggested that the water was contaminated since the start of drilling in that area. Taken together, the message is definitely not that unconventional extraction of fossil fuel is safe but rather that much more information is needed to understand the extent of the threat to drinking water resources.

Although this is not news to many of us who have studied the issue, the EPA report is notable for definitively stating that drinking water has been impacted by processes associated with unconventional fossil fuel extraction. For example, in Chapter 7, the EPA states "Scientific literature and published reports have shown that produced water spills have impacted drinking water resources." On wastewater treatment and waste disposal

(Chapter 8), “These unauthorized discharges represent both documented and potential impacts on drinking water resources. However, data do not exist to evaluate whether such episodes are uncommon or whether they happen on a more frequent basis and remain largely undetected.” We now know that the practice was not necessarily uncommon in California (see above). Also in Chapter 8: “Hydraulic fracturing wastewater discharged from treatment facilities without advanced TDS removal processes has been shown to cause elevated TDS, bromide, and chloride levels in receiving waters in Pennsylvania.” These are all examples of cases in which water was contaminated in processes associated with hydraulic fracturing, but the case is often made that hydraulic fracturing itself has not caused water contamination. The EPA concludes that, except in cases where fractures communicate with existing wells, the possibility of contamination due specifically to hydraulic fracturing in deeper formations such as the Marcellus (Pennsylvania, West Virginia, Ohio, New York, Maryland) and Haynesville (Louisiana, Texas) shales is unlikely, but that the possibility of contamination increases in more shallow resources such as the Antrim (Michigan) and New Albany (Illinois, Indiana, Kentucky) shales as well as portions of the Marcellus shale in New York State. However, in cases where oil and gas reservoirs are in the same formation as drinking water resources (e.g., coalbed methane formations), “The practice of injecting fracturing fluids into a formation that also contains a drinking water resource directly affects the quality of that water, since it is likely that fluid remains in the formation following hydraulic fracturing.” This is a dramatic departure from the EPA’s earlier assessment of hydraulic fracturing within a drinking water resource (EPA, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs*, June, 2004): “CBM [coalbed methane] production is dependent on the removal of large quantities of groundwater. EPA believes that this groundwater production, combined with the mitigating effects of dilution and dispersion, adsorption, and potentially biodegradation, minimize the possibility that chemicals included in the fracturing fluids would adversely affect USDWs [underground sources of drinking water].” It is refreshing that the EPA corrected this clearly erroneous assessment. These clear statements by the EPA should put to rest the idea that water has never been contaminated by processes associated with hydraulic fracturing. Given that the American Petroleum Institute has endorsed the findings of this report, one would hope that those individuals whose water has been contaminated by unconventional extraction will finally receive compensation and that the massive difficulties in adjudicating these issues will be ameliorated.

Perhaps the most important thing to note is that this EPA study is limited to drinking water. As we describe in our book, *The Real Cost of Fracking: How America’s Shale Gas Boom is Threatening Our Families, Pets, and Food* (Beacon Press), the impacts of unconventional extraction go far beyond drinking water and include, for example, air quality, noise, quality of life, traffic, crime, infrastructure, and economic activity. A full assessment of this large experiment in industrialization of the landscape cannot be limited to one variable that we still do not fully understand. The EPA study did little to decide the issue, and much more work will be required to understand the degree to which this process has widespread impacts. The long-term solution, however, is to move away from fossil fuels to renewable sources of energy. This is within our reach, but will require removal of the massive subsidies provided to the fossil fuel industry.

Robert Oswald and Michelle Bamberger

Links:

EPA study: <http://cfpub.epa.gov/ncea/hfstudy/recordisplay.cfm?deid=244651>

EPA study from 2004:

http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_exec_summ.pdf

Jim Inhofe:

http://www.epw.senate.gov/public/index.cfm?FuseAction=Majority.PressReleases&ContentRecord_id=7c0f5baa-a185-bae8-9cf8-7fc92a31474e

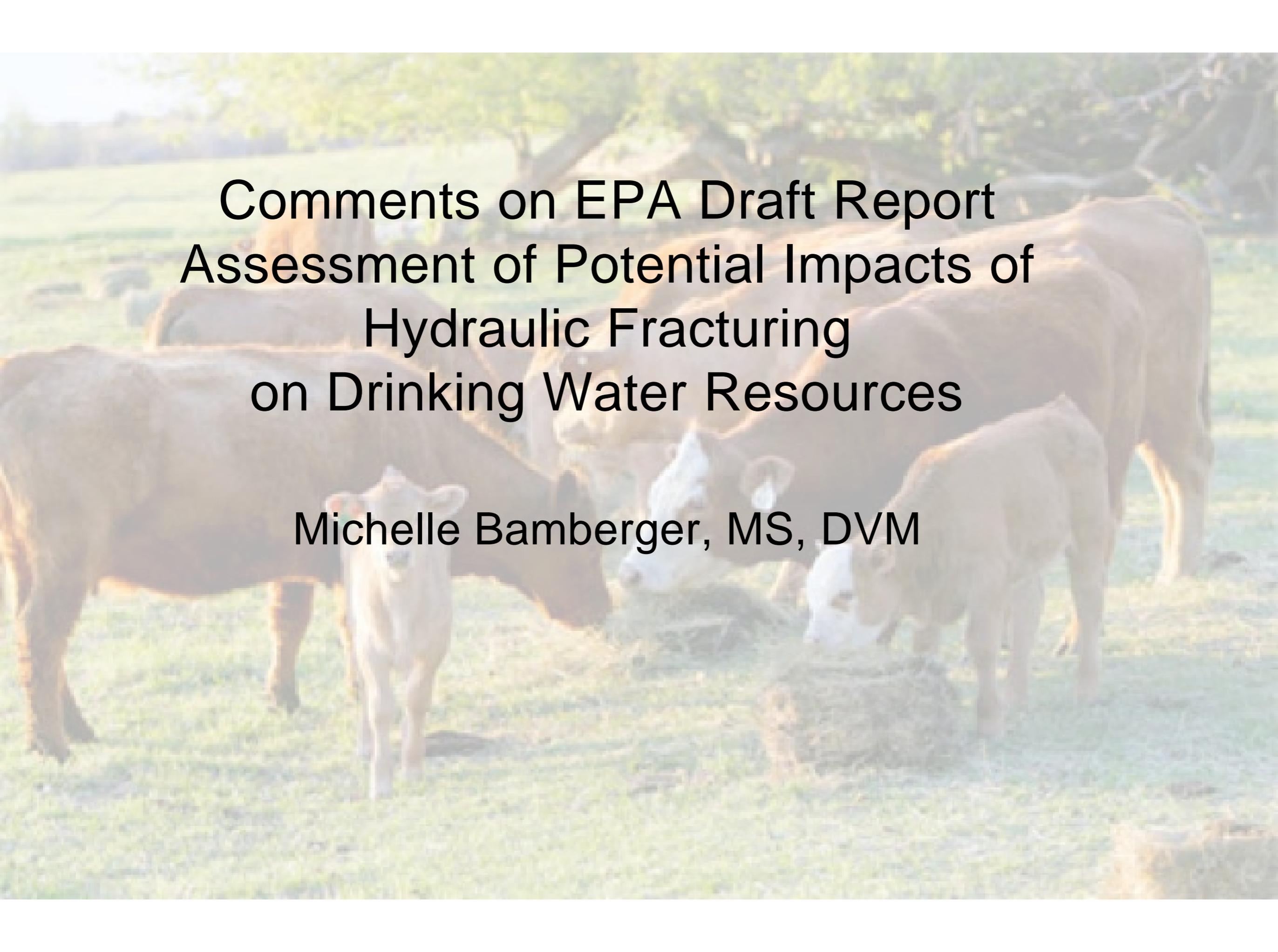
API link: <http://www.prnewswire.com/news-releases/api-epa-hydraulic-fracturing-review-confirms-safety-300094292.html>

Tom Burke link: <http://www.nytimes.com/aponline/2015/06/04/us/politics/ap-us-fracking-drinking-water.html>

Mark Nechodom link: <http://www.latimes.com/local/lanow/la-me-head-of-oil-regulating-agency-quits-20150605-story.html>

Environmental Science & Technology link:

<http://pubs.acs.org/doi/abs/10.1021/acs.est.5b01526>



**Comments on EPA Draft Report
Assessment of Potential Impacts of
Hydraulic Fracturing
on Drinking Water Resources**

Michelle Bamberger, MS, DVM

Bio

- Veterinarian, researcher and author.
- Studying impacts of hydraulic fracturing for oil & gas since 2009.
- Comments based on case report studies done in collaboration with Robert Oswald.^{1,2}

¹ M. Bamberger & R.E. Oswald (2012) Impacts of gas drilling on human and animal health. *New Solutions*, 22 (1), 51-77.

² Bamberger, M. and Oswald, R.E. (2015) Long-term impacts of unconventional drilling operations on human and animal health. *Journal of Environmental Science and Health Part A* 50, 447-459.

First Case Report Study

- Water changes reported after drilling and hydraulic fracturing.
- Food animals and companion animals—reproductive problems.
- Humans: burning eyes, nose, throat, headaches, GI problems, nosebleeds, rashes.

M. Bamberger & R.E. Oswald (2012) Impacts of gas drilling on human and animal health. *New Solutions*, 22 (1), 51-77.



Second Case Report Study

- Health impacts decrease with decrease in drilling operations.
- Distribution of symptoms change over time in food animals.
- Reproductive impacts fall; respiratory & growth impacts increase.

Bamberger, M. and Oswald, R.E. (2015) Long-term impacts of unconventional drilling operations on human and animal health. *Journal of Environmental Science and Health Part A* 50, 447-459



Assessment of Livestock Drinking Water

- Hydraulic fracturing occurs mainly in agricultural areas.
- Herds exposed to HF fluids, wastewater, contaminated drinking water.
- Only one case quarantined, yet many herds exposed.
- Food safety concerns.

M. Bamberger & R.E. Oswald (2012) Impacts of gas drilling on human and animal health. *New Solutions*, 22 (1), 51-77.

