

Impacts of Gas Drilling and Infrastructure on Human and Animal Health

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What do we mean by “fracking”?



Silica Mining



Trucking



Drilling



Hydraulic Fracturing



Impoundments



Condensate Tanks



Flaring



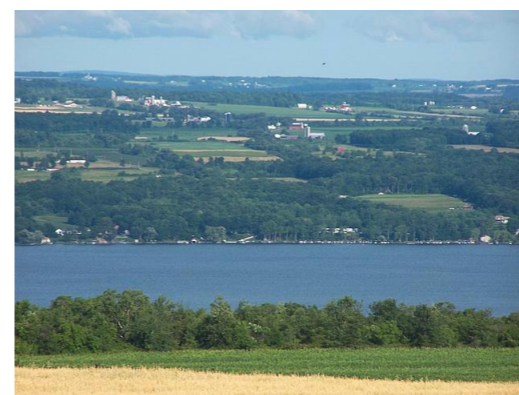
Compressor Stations



Processing Plants



Pipelines



LNG and LPG Storage



LNG terminals

Sentinels

- Animals: breeding schedules, generation times
- Children: higher metabolic rates, immature detoxifying systems
- Babies: birth defects,¹ low birth weight, small for gestational age, reduction of APGAR scores,² preterm birth, high-risk pregnancy³

¹McKenzie, L. et al. (2014) Birth Defects and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, *Environ Health Perspect*, 122(4):412-417.

²Hill, E. (2012) Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, <http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf>

³Casey, J. A. et al (2015), Unconventional Natural Gas Development and Birth Outcomes in Pennsylvania, USA, *Epidemiology*. 2015 Sep 30. [Epub ahead of print]

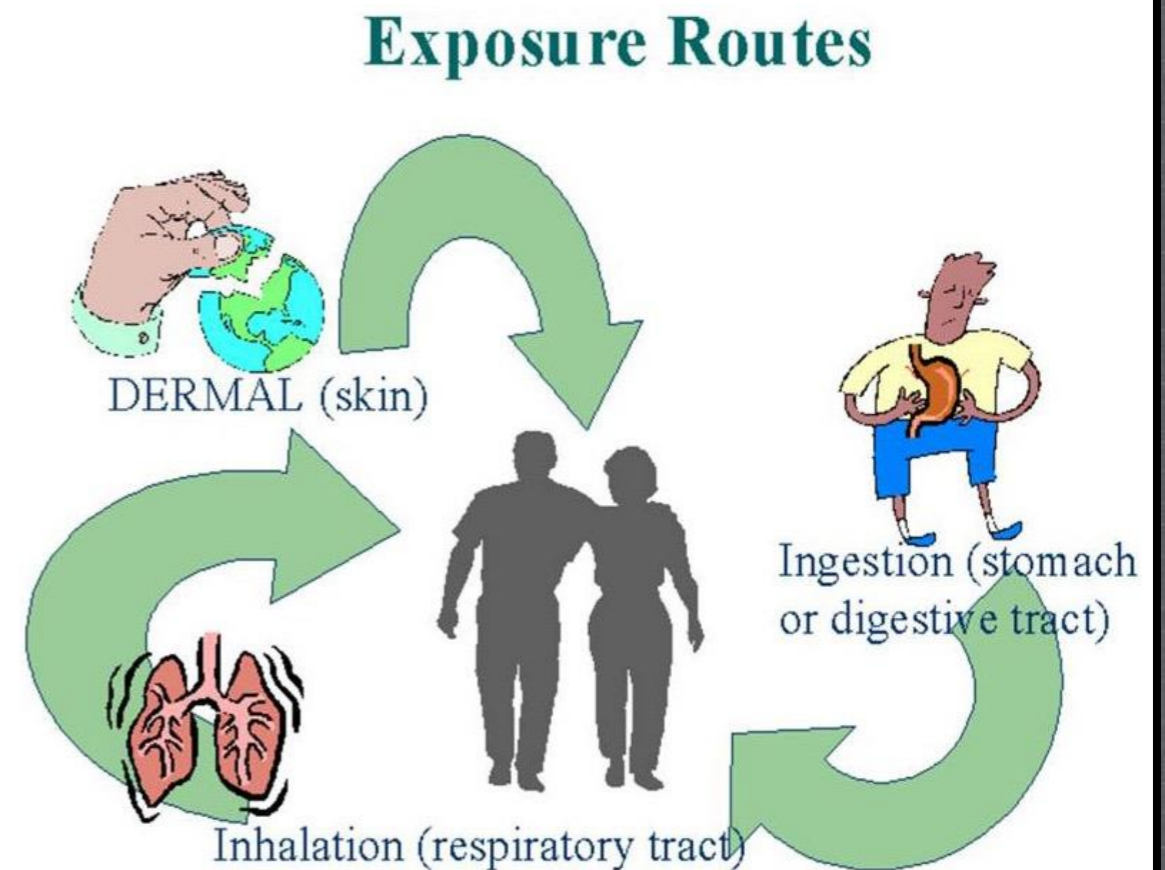


First Case Report Study

Did health change after drilling operations began?

- Collect data on cases.
- Timeline of events.
- Routes of exposure.

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



Natural Controls

Split Herds

- Part of herd exposed to wastewater after liner allegedly split.
- Part of herd exposed to a creek where wastewater allegedly dumped.
- Part of herd exposed to affected well water after casing failure.

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



First Case Report Study

Health changes after drilling:

- 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

Follow-up period averaged 25 months

- Do health impacts change over time?
- Does location matter?

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



Second Case Report Study

Does location matter?

- 8/9 cases where industrial activity decreased, all health impacts decreased in people and animals.
- Includes cases where families moved away.

Bamberger, M. and Oswald, R.E. (2014) Long-term impacts of unconventional drilling operations on human and animal health. *Journal of Environmental Science and Health Part A* 50, 447-459



Case: Sarah & Josie

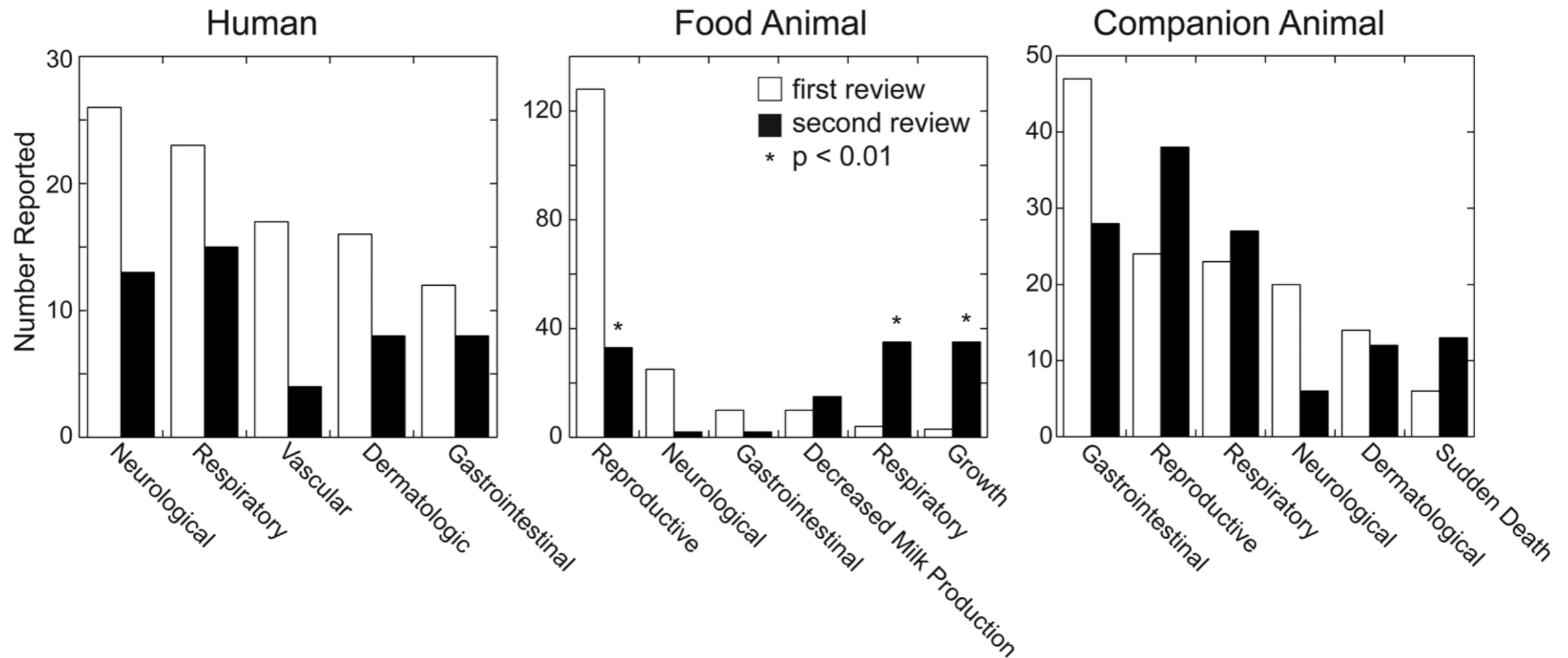
- Water and air changes after drilling operations.
- Coincident morbidity and/or mortality in animals, people.
- Animal deaths alert child's physician to toxicity as cause of illness.

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



Second Study: Health Changes Over Time

Number of Humans and Animals with Symptoms



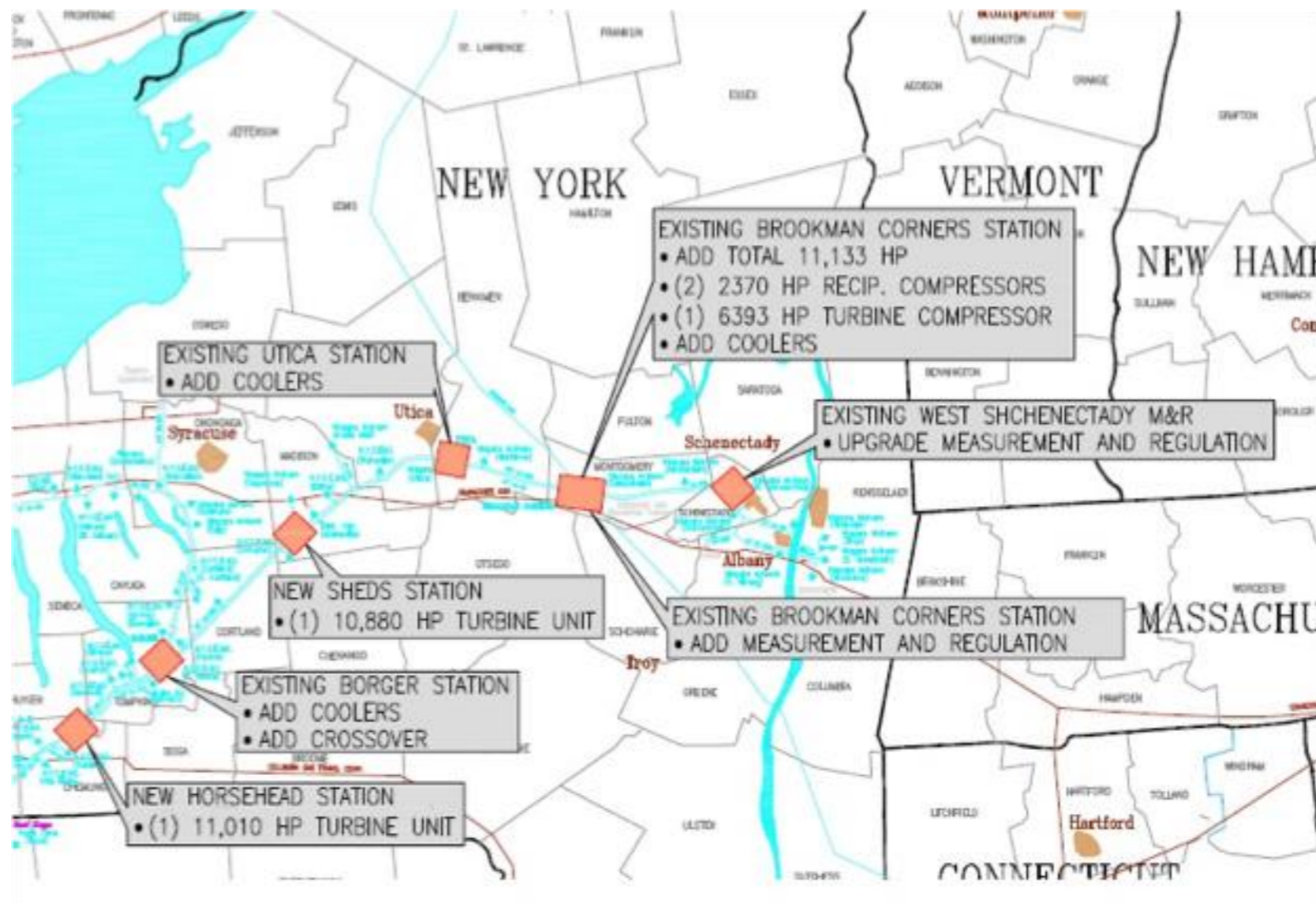
Food Safety

- Only one herd quarantined, yet all herds had known exposures
- Farms in area with known exposures are still producing food products without testing of the plants, animals or the products
- In PA, milk production and number of cows is significantly decreased in intensively drilled counties compared to counties with little or no drilling[§]

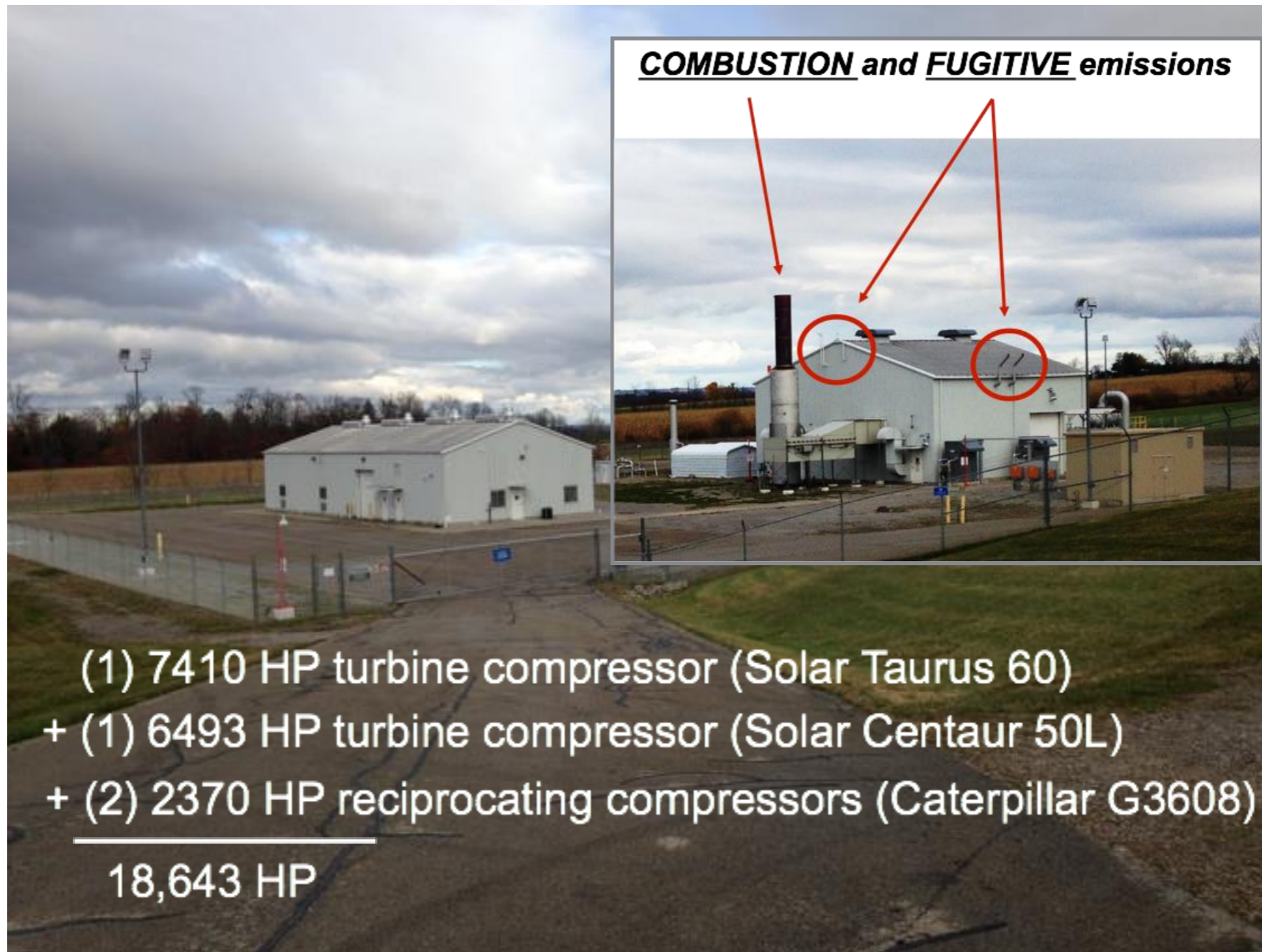
[§]Finkel *et al.* (2013) Marcellus shale drilling's impact on the dairy industry in Pennsylvania: A descriptive report. *New Solutions* **23**, 189-201.



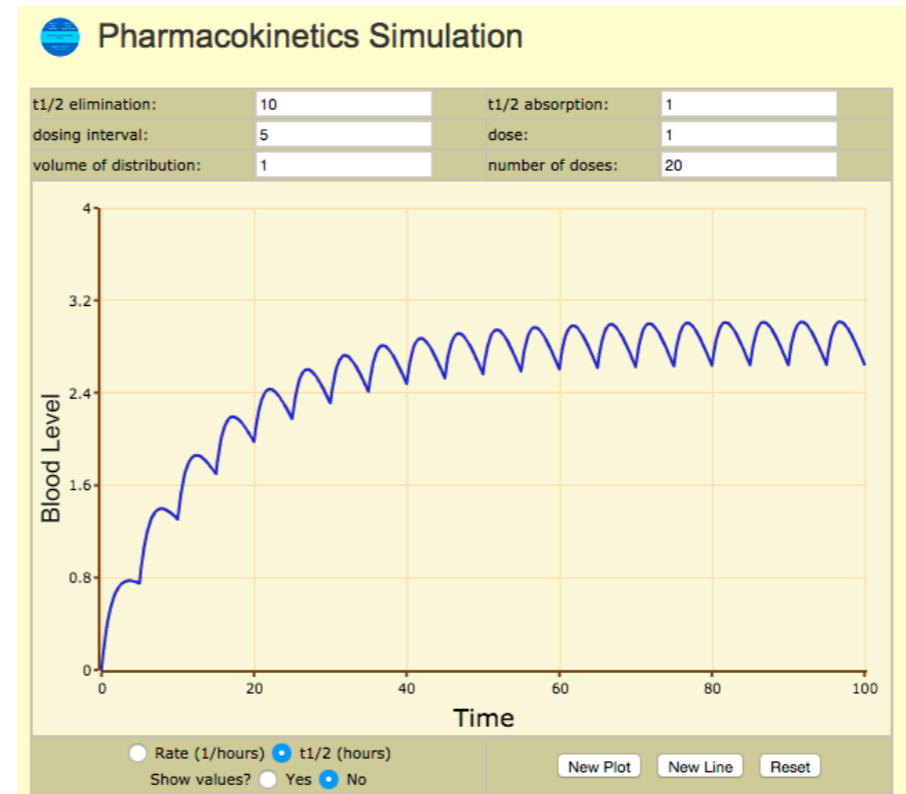
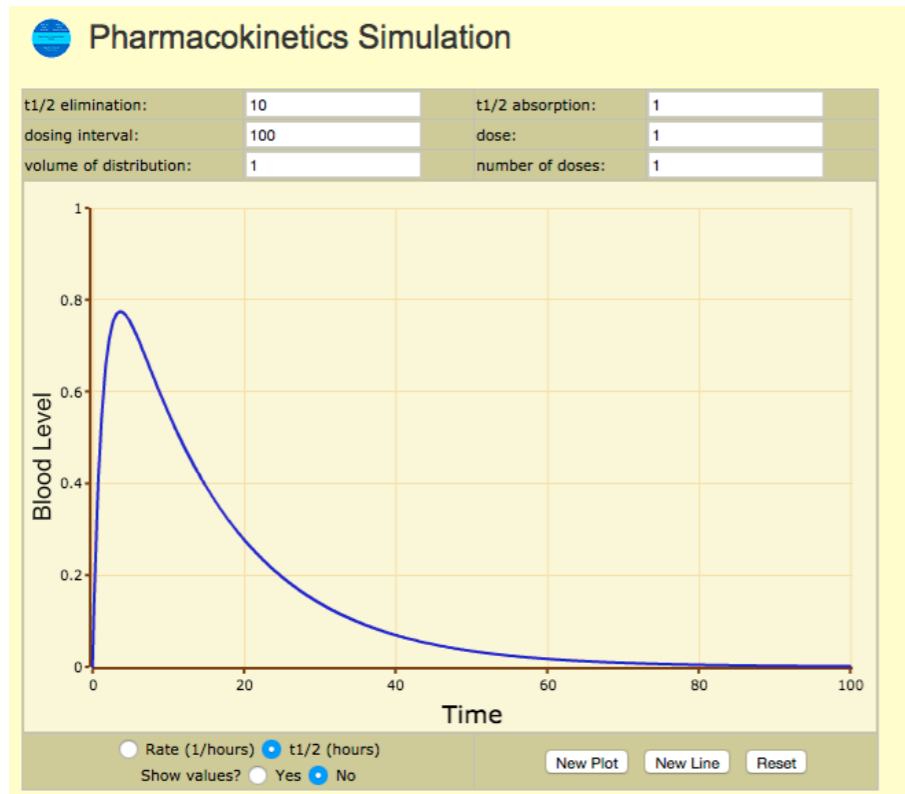
Dominion New Market Project



Brookman Corners Compressor Station



Why do we worry about compressor stations and processing plants?



- With isolated events (e.g., one time flaring of a well), blood levels of a toxicant rise but fall usually within hours to days to a undetectable level.
- With continuous process (perhaps greater release at night), blood levels of a toxicant can rise and achieve a steady-state.

Food Animal Monitoring



Food Animal Monitoring



Food Animal Monitoring



Food Animal Monitoring

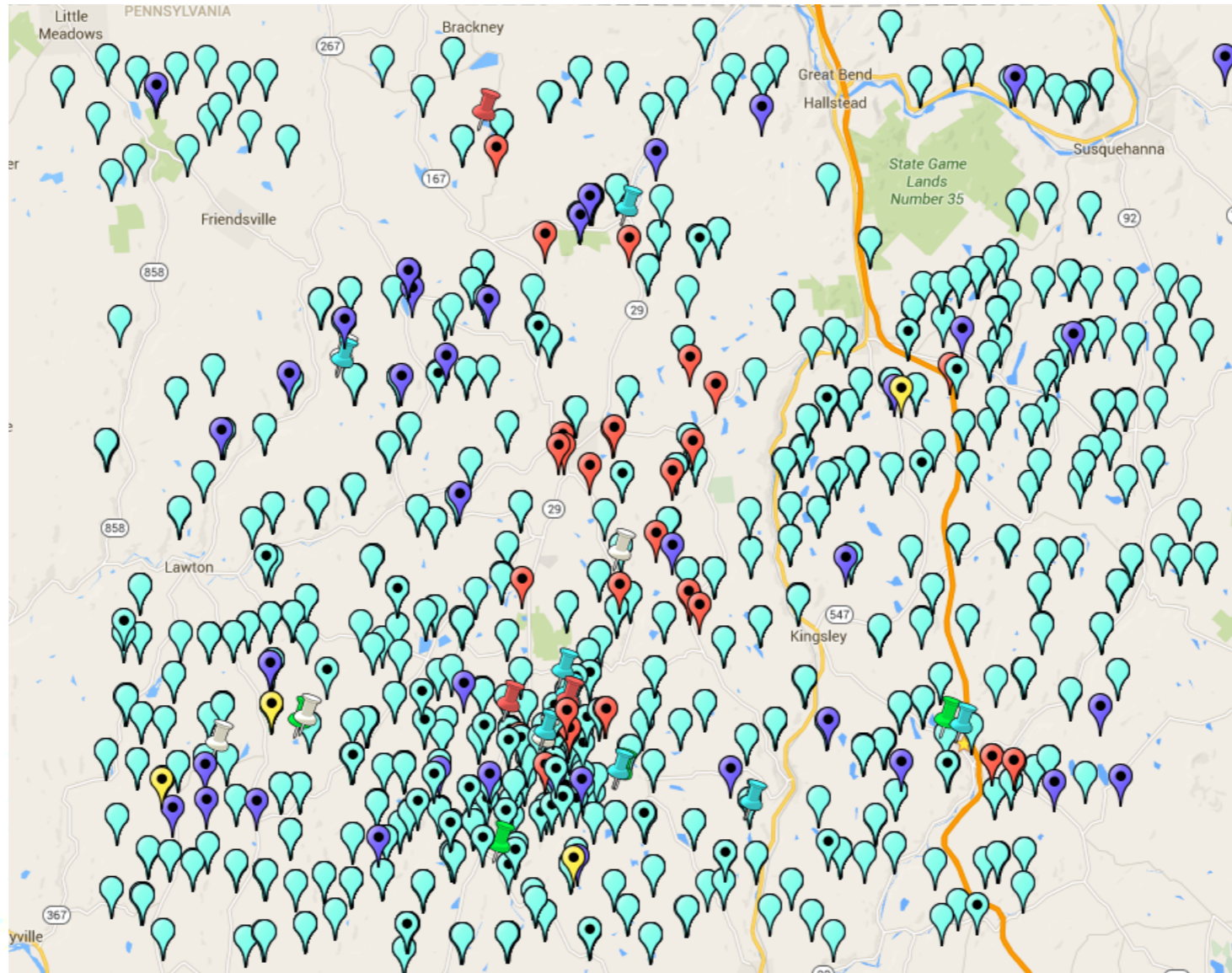


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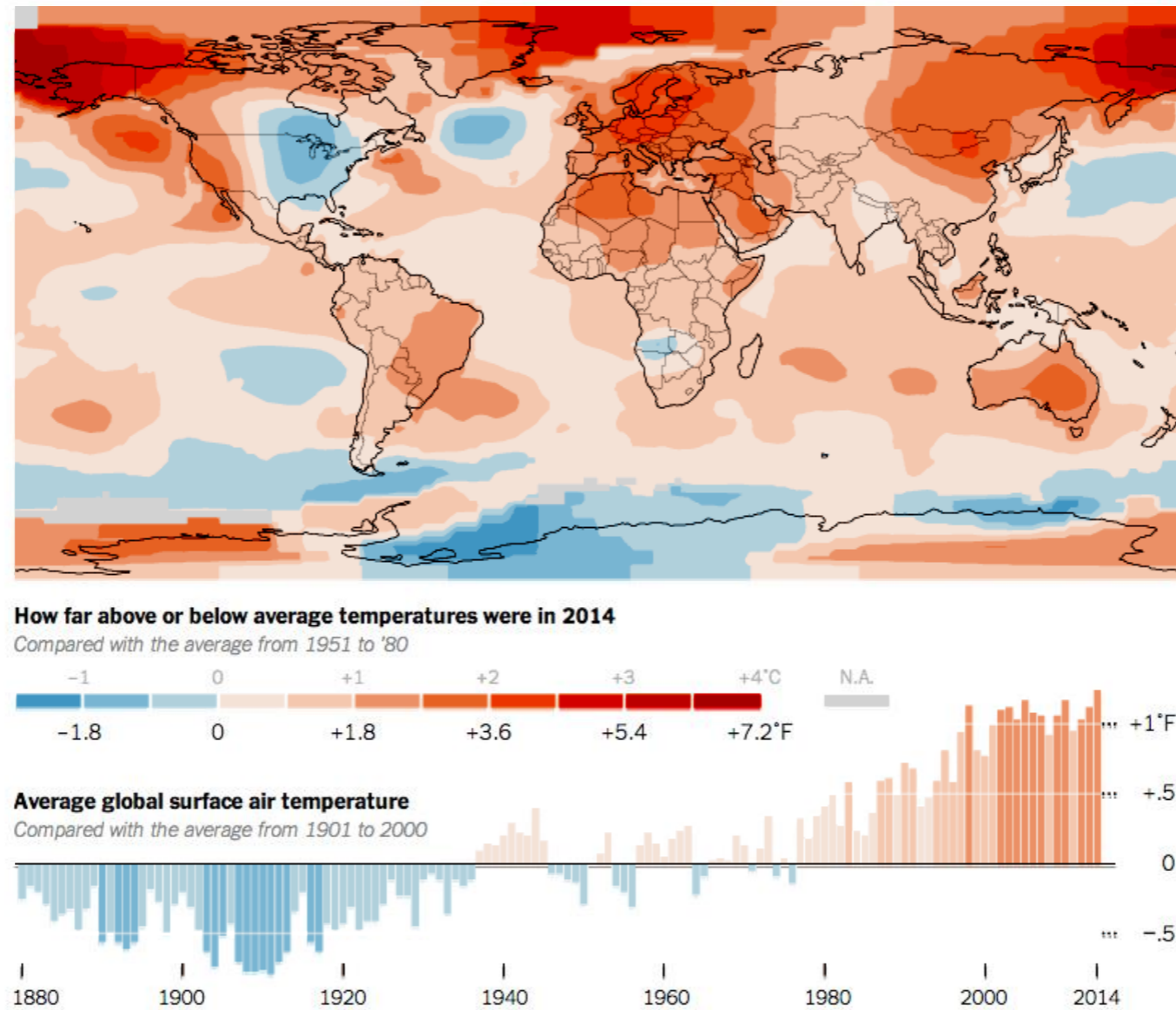
Water Testing

- Collect 1 liter of water
- Concentrate and extract organics
- Test for biological activity (Estrogen and Aryl Hydrocarbon Receptors) using yeast assays
- Fast and easy assay that does not require testing for individual chemicals
- Identify compounds in positive samples using GC/MS

Water Testing

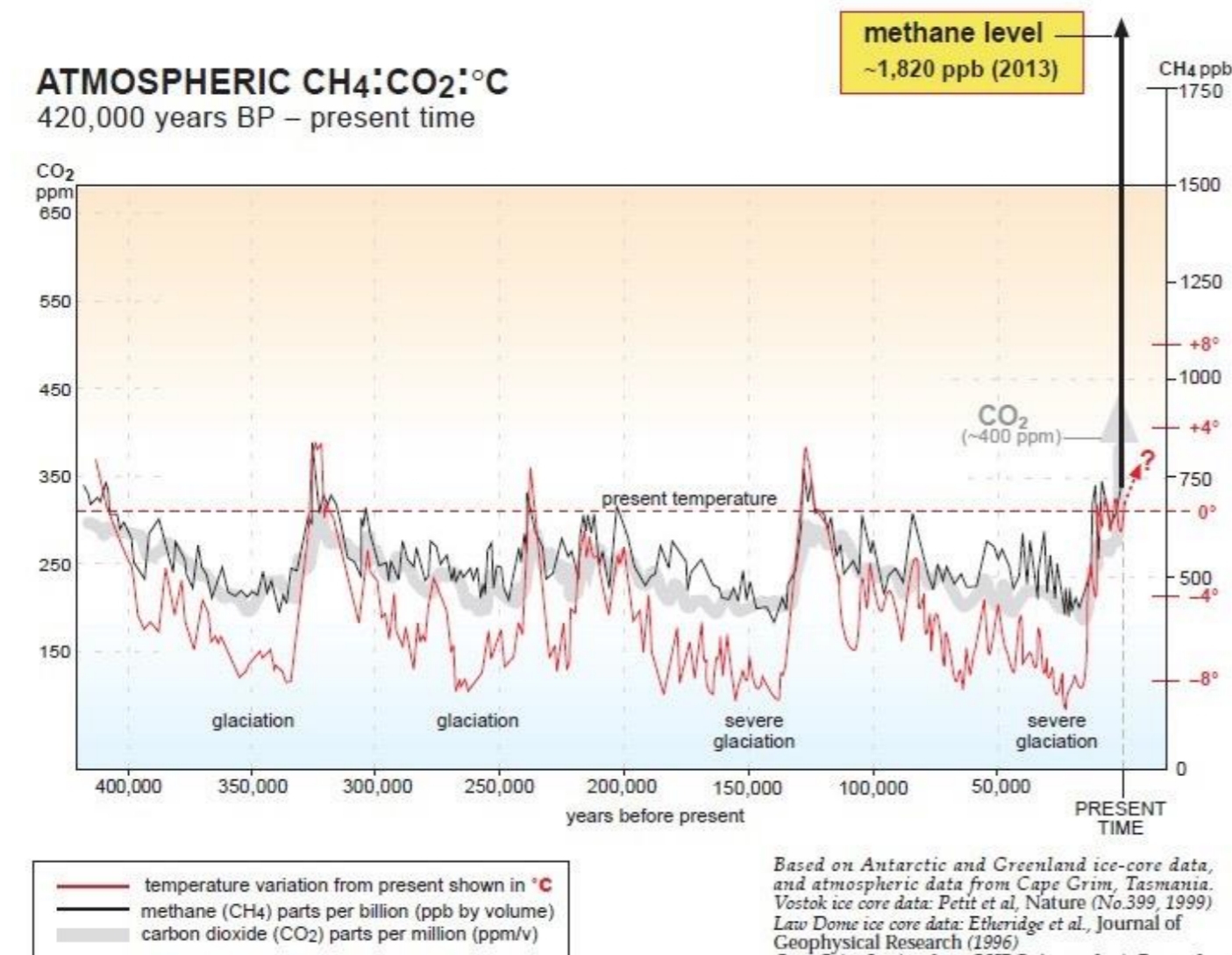


Climate Change



http://www.nytimes.com/2015/01/17/science/earth/2014-was-hottest-year-on-record-surpassing-2010.html?_r=1

Dangers of Methane Leakage and Venting



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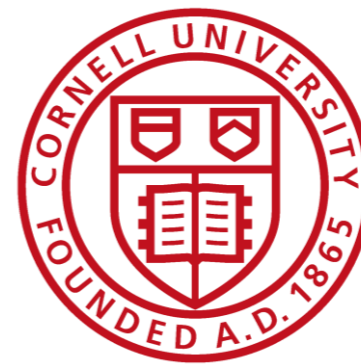
- Both methane and CO₂ are at levels in the atmosphere higher than the last 400,000 years.
- Methane is 100x more potent than CO₂ over 10 years.
- Rise in methane is largely due to agriculture and extracting and release of methane from fossil fuel production and distribution.

Funding

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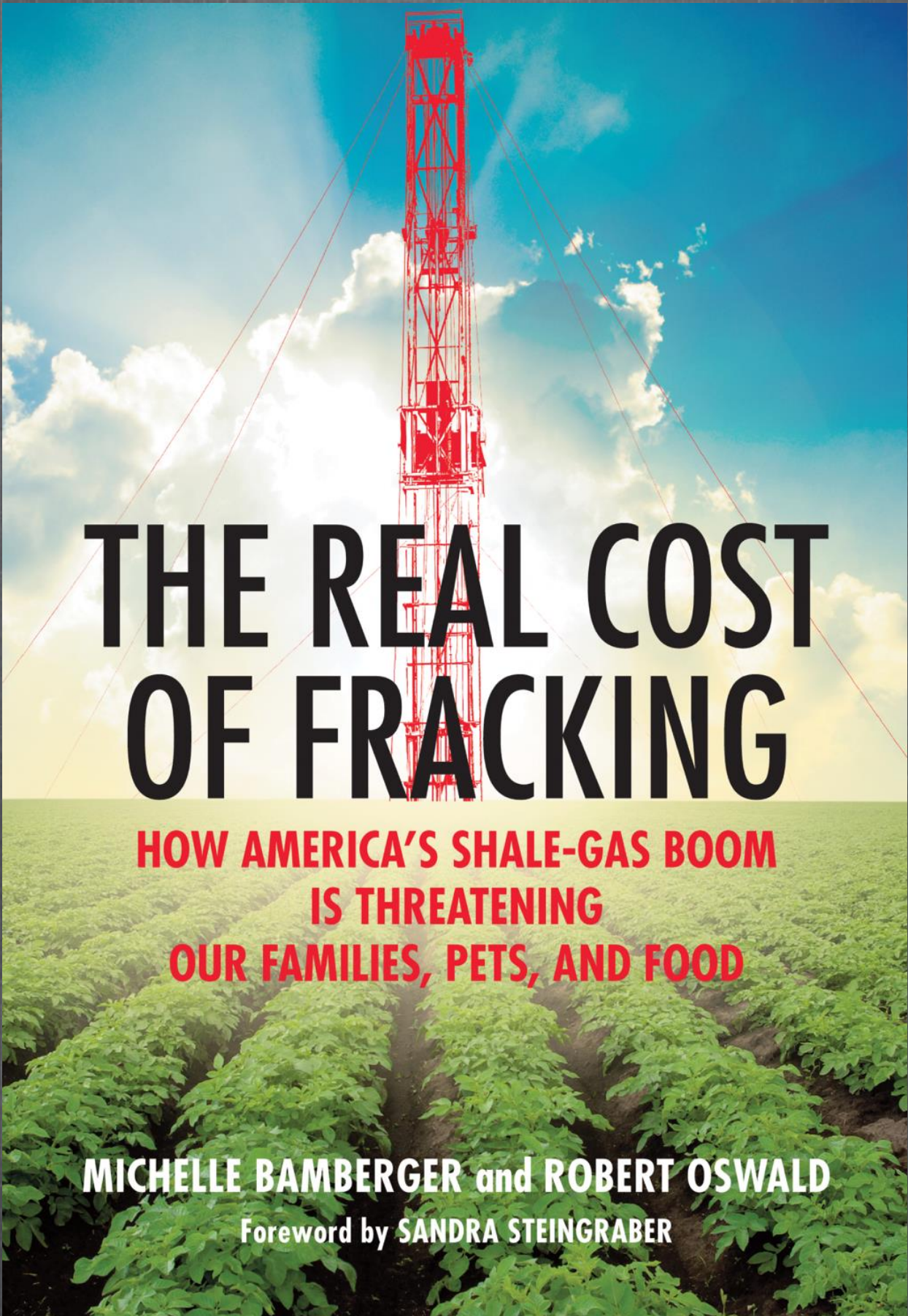


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THE REAL COST OF FRACKING

**HOW AMERICA'S SHALE-GAS BOOM
IS THREATENING
OUR FAMILIES, PETS, AND FOOD**

MICHELLE BAMBERGER and ROBERT OSWALD

Foreword by **SANDRA STEINGRABER**