

Unintended Health and Environmental Consequences of CAFO Agriculture

Bob Watson and Larry Stone

This presentation will present the perspective that **CAFOs - confinements and feedlots - are wastewater technology** which has been inappropriately transferred to agriculture.

Using this perspective, we will provide a context that will give you a different way to view this CAFO model of agriculture.

Unintended consequences have occurred:

- because the unregulated sector of agriculture adopted technologies designed for use in **industrial/municipal wastewater treatment**;
- but the training, regulations, public safety, and engineering used in the **wastewater industry** have not been carried over to industrial agriculture.

We discuss:

- the technology,
- its inherent industrial poisons,
- its effects on people's health, and
- how people can be protected.

We avoid:

- emotional arguments about animals,
- the treatment of animals,
- private property, and
- models of agriculture.

We simply address the **interface** between **industrial poisons** and the **public**.

This manure collection technology has produced **unintended consequences**. Some include:

- creation of an environment suitable for MRSA and other antibiotic-resistant organisms.
- the release of air-borne toxins
 - **hydrogen sulfide (H₂S)**,
 - **methane (CH₄)**,
 - **ammonia (NH₃)**,
 - **particulates**, and
 - **drug-resistant organisms**;
- explosive conditions inside the confinements; and
- nitric acid rain.

This is not a blame game.

No one originally understood the human health costs, environmental degradation, and pollution that would result from using these technologies in agriculture.

As such, we should all bear the costs of transitioning to a biologically benign agriculture.

Please keep in mind during this presentation that the focus of most individuals, corporations, and government entities is

“you can’t regulate poisons coming from agriculture,”

rather than focusing on the uncomfortable fact that

“people - especially children - are breathing poisons from agriculture.”

This presentation will include:

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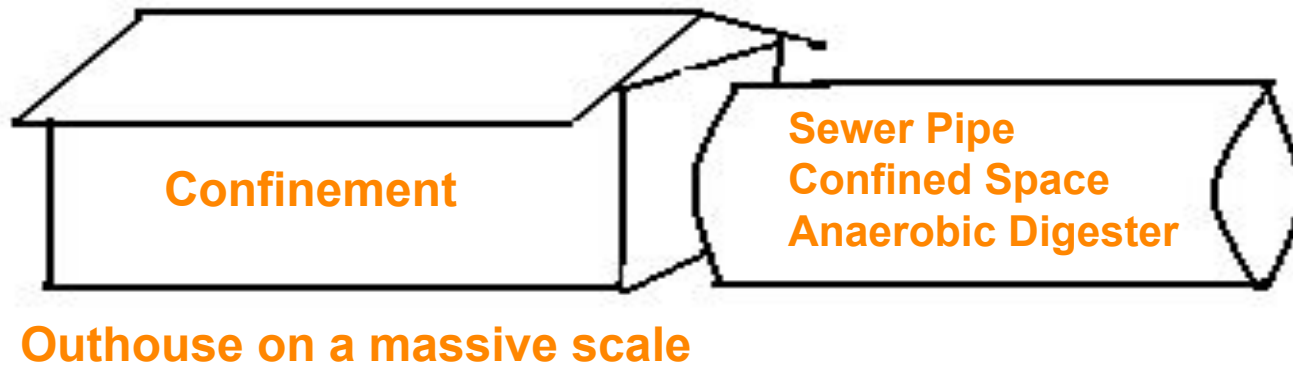
An explanation of the **technology** that **creates the same sewer environments** in both ~~CAFOs~~ and the ~~wastewater industry~~.

A discussion of the regulations and design that have matured with this technology, but that have not been transferred to agriculture with that technology.

We will proceed to specific examples of unintended consequences:

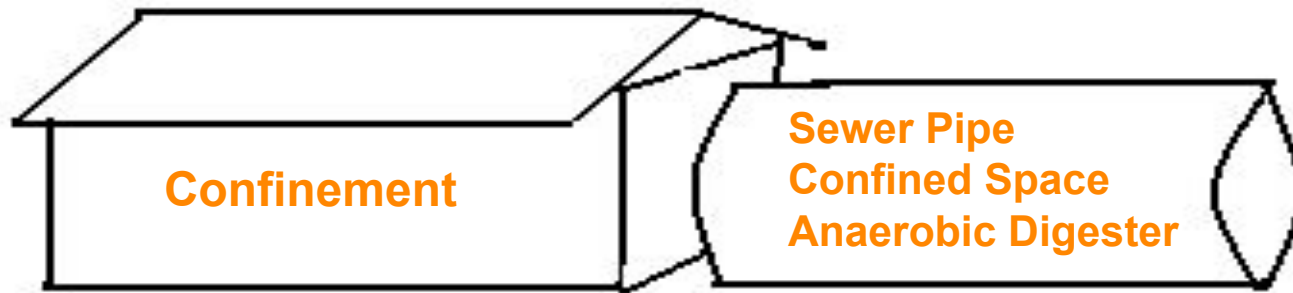
- Increase of deaths and fires in confinements from foaming problems.
- The new acid rain - **nitric acid rain** - much of which can be traced to agriculture.
- Health impacts on people.

Then we will dispel some common myths.



Similarities Between CAFOs and Waste Water Treatment:

- Both are closed spaces.
- Both have untreated fecal waste in them.
- That waste constantly generates antibiotic-resistant organisms, particulates, and poison sewer gases: hydrogen sulfide, ammonia, the explosive and green-house gas methane.
- Inherent in the technology: If you use this technology, these things must happen.
- Causes of diseases and death from those gases are the same.
- Constant ventilation is needed to survive in either.



Outhouse on a massive scale

Differences Between CAFOs and Waste Water Treatment:

- Sewers are designed to contain the poison gases, while **confinements are designed to blow poison gases into the surrounding neighborhood.**
- The waste in sewers is ultimately treated; **confinement waste is not treated.** Problems are prior to treatment, and would exist even if waste was treated.
- There are **no regulations for confinements** that provide **for educating and training** about, and protections from, a hazardous work place.
- There are **no regulations protecting the public from the poisons created in confinements.** There ARE such regulations for sewage treatment, and for everywhere else in which there is fecal waste producing hydrogen sulfide, ammonia, and methane gases in a closed structure.

Summary of toxicology for Hydrogen Sulfide

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High Concentrations

- respiratory paralysis...may cause coma after a single breath and may be rapidly fatal.
- convulsions.
- acute conjunctivitis with pain, lacrimation, and photophobia.
- keratoconjunctivitis and vesiculation of the corneal epithelium.
- pulmonary edema.
- rhinitis, pharyngitis, bronchitis, and pneumonitis.
- rapid olfactory fatigue.

Low Concentrations

- irritates the eyes and respiratory tract.
- headache, fatigue, irritability, insomnia, and gastrointestinal disturbances.
- dizziness.

Summary of toxicology for Ammonia

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- Ammonia vapor is a severe irritant of the eyes, especially the cornea, the respiratory tract, and skin.
- Dyspnea, bronchospasm, chest pain and pulmonary edema which may be fatal.
- Bronchitis and pneumonia.
- Asthma.
- Ironically, a 1969 study to set human limits for ammonia was done on pigs.

Stombaugh DP, Teague HS, & Roller WH (1969 June). Effects of atmospheric ammonia on the pig. *Journal of Animal Science*, 28(6): 844-847.

Health Impacts on People

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- **Asthma and Farm Exposures in a Cohort of Rural Iowa Children (2005)**
 - *Environmental Health Perspectives*, 113(3): 350-356.
 - James A. Merchant, Allison L. Naleway, Erik R. Svendsen, Kevin M. Kelly, Leon F. Burmeister, Ann M. Stromquist, Craig D. Taylor, Peter S. Thorne, Stephen J. Reynolds, Wayne T. Sanderson, and Elizabeth A. Chrischilles
 - **School Proximity to Concentrated Animal Feeding Operations and Prevalence of Asthma in Students (2006)**
 - *CHEST*, * 129(6): 1486-1491.
 - Sigurdur T. Sigurdarson and Joel N. Kline
- * = Journal of the American College of Chest Physicians

The Two Studies in Brief

Iowa's overall rate of asthma is about **6.7%**.

- To generalize the studies, it has been found that if a rural school has a confinement within 10 miles, **11.7%** of the children exhibit **asthma** health outcomes – nearly **twice the state rate**.
- If a confinement is within ½ mile of a school, **24.6%** of children exhibit **asthma** health outcomes – **four times the state rate**.
- And if you are a kid unlucky enough to live on a farm with a confinement that adds antibiotics to feed, there is a **55.8%** chance you will experience **asthma** health outcomes – **nine times the state rate**.

Research Packets Available for Boards of Health

- **192 CAFO Research Studies**
 - **Impact of CAFOs on Workers and Farmers (29)**
 - **Impact of CAFOs on Neighbors & the Environment (62)**
 - **Impact of Hydrogen Sulfide on Health (32)**
 - **Problems with CAFO Operations (6)**
 - **Toxic & Greenhouse Gas Emissions from Agriculture, i.e., CAFOs et al (61)**

- **296 MRSA Research Studies**

- **Detection of MRSA in Livestock (34)**
- **Links Between Human Exposure to Pigs and Human MRSA Colonization / Infection (96) (IC VA Study)**
- **MRSA in Meat Products (12)**
- **Impact of Pig Fecal Slurry Applications to Ag Fields on Microbial Soil Organisms, on Soil, & on Groundwater (53)**
- **Spread of Swine MRSA to Wildlife (11)**
- **Spread of Swine MRSA via Field Applications of Swine Slurry (13)**
- **Other Antibiotic-resistant Pathogens Resulting from Ag Use of Antibiotics (50)**
- **Risks to Human Health Posed by MRSA Colonization (27)**

Measures and Precautions You Can Take to Protect Yourself

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- 1. Put correct bio-filters in your HVAC system that will filter out hydrogen sulfide and ammonia gases. At least you will be safe in your own home.**
- 2. Cancel, or do not renew, any hog waste application contracts you have signed.**
- 3. Ask neighbors to cancel or to not renew any hog waste application contracts they have signed.**
- 4. Restrictive covenants.**

Measures and Precautions You Can Take to Protect Yourself

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- 4. If you wish to file a nuisance law suit, start keeping a log of times and dates, both inside and outside of your house, when odor is present. Nuisance suits have not shut down confinements, but might get you a fair market buyout if you want to move. Include baseline well testing in your log.**
- 5. Keep your children away from confinements and fields where confinement waste has been applied.**

Measures and Precautions You Can Take to Protect Yourself

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6. If hospitalized, make sure you tell your doctor you may be colonized with MRSA due to living in proximity to confinements and/or fields where confinement waste is applied. If you are already colonized with MRSA, your chances of getting a MRSA infection increase.
7. Move.

Op Ed: Fundamental Problems

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Sept. 2010, by Bob Watson

- Based on conversations with producers at the World Pork Expo, this op-ed concerned the problem of foaming in pits beneath hog confinements, exacerbating the already serious problem of dead pigs and flash fires caused by hydrogen-sulfide and methane
- “I wish we had the answer,” said Angela Rieck-Hinz of ISU, writing in August on the Iowa Manure Management Action Group website, “but at this point in time we still have no answers as to what is causing the foaming or how best to control or manage the foam. If you have information regarding foaming pits you would like to share please contact me. In the meantime, I urge caution when pumping from manure pits. Be aware of safety concerns regarding manure gases, pit fires and explosions. Not all pit fires and explosions have happened in barns with foaming pits.”

Op Ed: Fundamental Problems

Sept. 2010, by Bob Watson



David Pressler, Exec. Director, Minnesota Pork Producers Association

There may be many causes for the upswing in foaming problems.

- The wastewater industry understands these causes:
 1. Old fecal seed stock
 2. Volume of waste being deposited into the pit over time versus the total volume that the pit can hold. When the volume of waste increases as a percentage of the total volume of the pit, foaming increases.
 3. The water-manure ratio also impacts foaming.
 4. The amount & kind of ventilation exerts an impact.

5. Increased feeding of DDGs (Dried Distiller Grain) from ethanol plants has two impacts on increased foaming:
 - Undigestible roughage increases the volume of waste;
 - Undigestible roughage increases the organic loading of the waste being deposited by animals;
 - Addition of uncounted antibiotics to pigs and waste.
6. Barn-cleaning chemicals; and
7. Consumption of genetically modified corn or soybeans leads to significant organ disruptions, particularly in liver and kidneys, which affects the quality of the waste.

There is no ability for confinement operators to control the foaming problem because they can't mix the pit.

- A 2009 ISU report reviewed literature that cited CAFO fires from as long ago as 1969.
- Thus, it's disturbing that no research questioned the confinement technology that may lead to these explosions.
- Causes of foaming are best understood when you realize that **CAFOs are wastewater technology**.

Consequences of foaming:

Normally, gases tend to stay in suspension in a liquid; to get out they must break the surface tension

1. Foaming increases surface area.
2. Foaming provides a direct path to the pigs. The gas does not have to disperse and travel through air to get to the pigs.
3. The pigs bite/eat the foam, or the foam breaks, and the pigs die from hydrogen-sulfide.
4. The methane also has a direct path to the confinement area, resulting in higher incidence of methane flash fires.

The **crux of the problem** is that confinement advocates have **inappropriately transferred wastewater technology** from the highly regulated sector of municipal and industrial wastewater to the unregulated – in terms of wastewater – sector of industrial agriculture.

In the wastewater industry, we learned long ago – after workers became ill or died - that we could not put normal workspaces in proximity to areas where fecal waste is decomposing.

The constant production of the **poisonous** and **explosive gases** –

- **hydrogen sulfide** (H_2S),
- **ammonia** (NH_3), and
- **methane** (CH_4)

– was finally taken into account in designing wastewater facilities and technology that would protect both the workers and the surrounding public.

Those protections have been codified in the **regulations and design standards that control** municipal/industrial wastewater technology. But **industrial agriculture remains exempt**.

To date, the following entities **deny** that **CAFOs** are a form of **wastewater technology**:

- The **Iowa Legislature**,
- the **Iowa Department of Natural Resources**,
and
- **corporate industrial agricultural** officials.

Although seeming illogical, in fact a DNR construction permit requires this type of building, resulting in these problems.

Nitric acid rain: September 2010

Scientific American article “Sour Showers” by Michael Tennesen

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- “Acid rain is back – this time triggered by nitrogen emissions. The acid rain scourge of the 1970s and 1980s that killed trees and fish and even dissolved statues on Washington, D.C.’s National Mall has returned with a twist. Rather than being sulfuric acid derived from industrial sulfur emissions, the corrosive liquid is **nitric acid**, which has resulted not just from smokestacks but also from farming.”
- National Problem

Sour Showers

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Sept. 2010 Scientific American, By Michael Tennesen

- People or organizations mentioned include:
 - **Viney P. Aneja**, professor of air quality and environmental technology at North Carolina State University;
 - the Hubbard Brook Experimental Forest in New Hampshire's White Mountain National Forest;
 - **William H. Schlesinger**, president of the Cary Institute for Ecosystems Studies in Millbrook, NY;
 - the 1999 Gothenburg Protocol; and a
 - 2009 paper in Environmental Science & Technology.

Sour Showers

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Sept. 2010 Scientific American, By Michael Tennesen

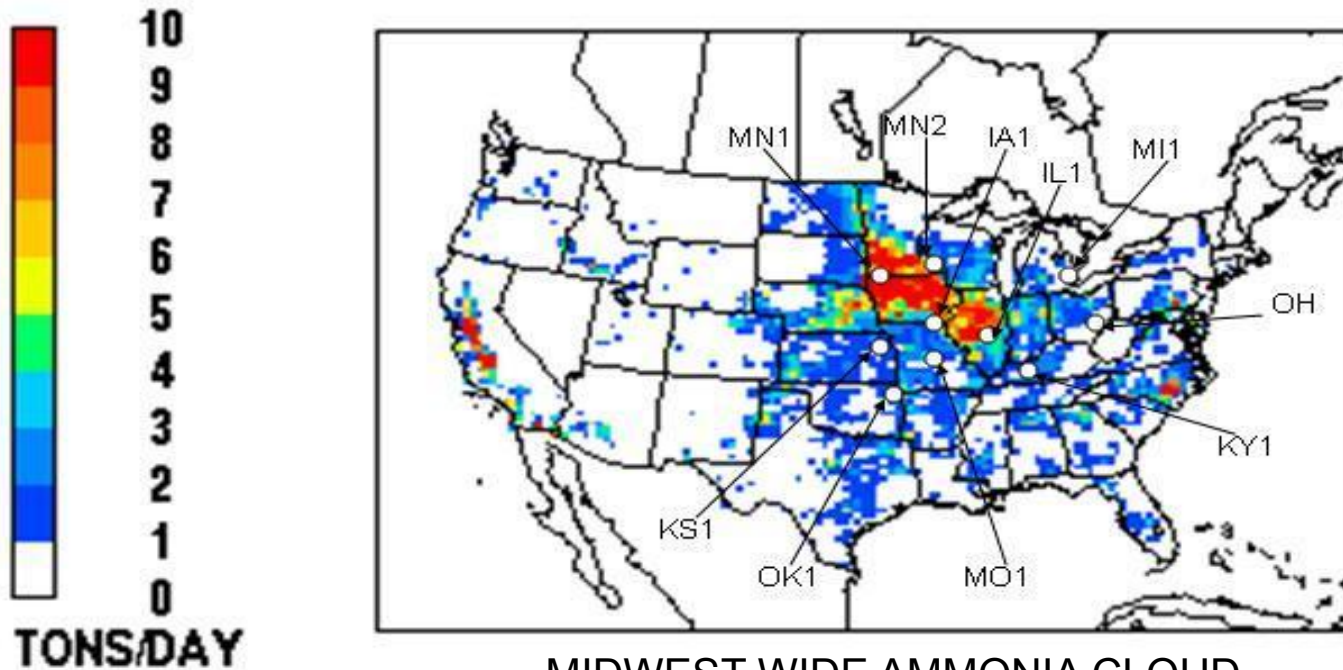
- The Integrated Nitrogen Committee of the EPA's Science Advisory Board generated a draft report in 2009 followed by a final report in 2011 that lays out the details, including management options for nitric acid rain.

Reactive nitrogen in the United States: An analysis of inputs, flows, consequences, and management options: A report of the EPA Science Advisory Board.

- The report also discusses ways to monitor atmospheric emissions, currently the weak link in the nitrogen-control picture. The report may be accessed at:

<http://permanent.access.gpo.gov/gpo21530/EPA-SAB-11-013-unsigned.pdf>

Ag ammonia causes nitric acid rain



MIDWEST WIDE AMMONIA CLOUD

COURTESY OF DONNA KENSKI, Phd.

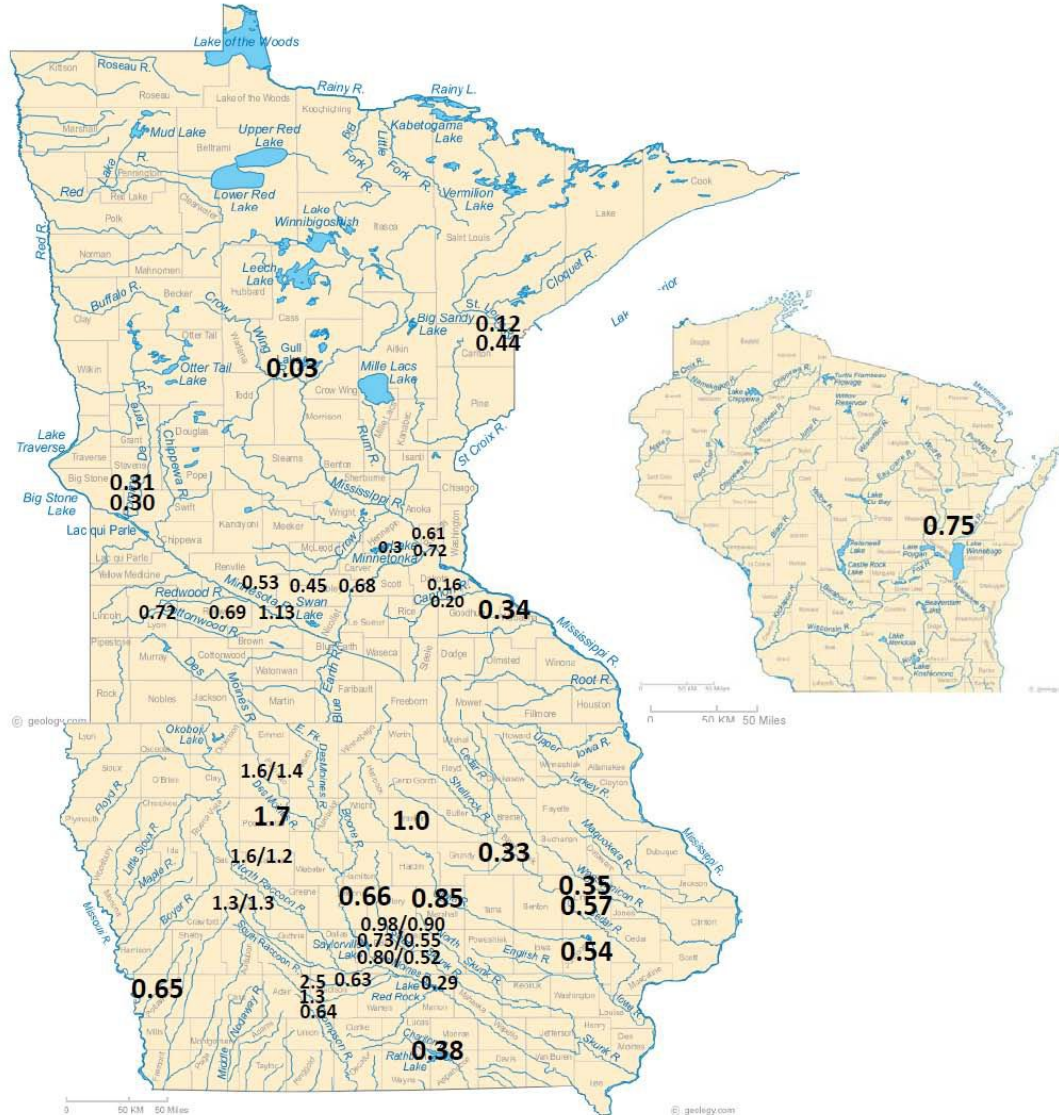
LAKE MICHIGAN AIR DIRECTORS CONSORTIUM,
DES PLANES, IL

•Ammonia from confinements, open feedlots, and volatilization of anhydrous ammonia applications drifts east and falls to earth

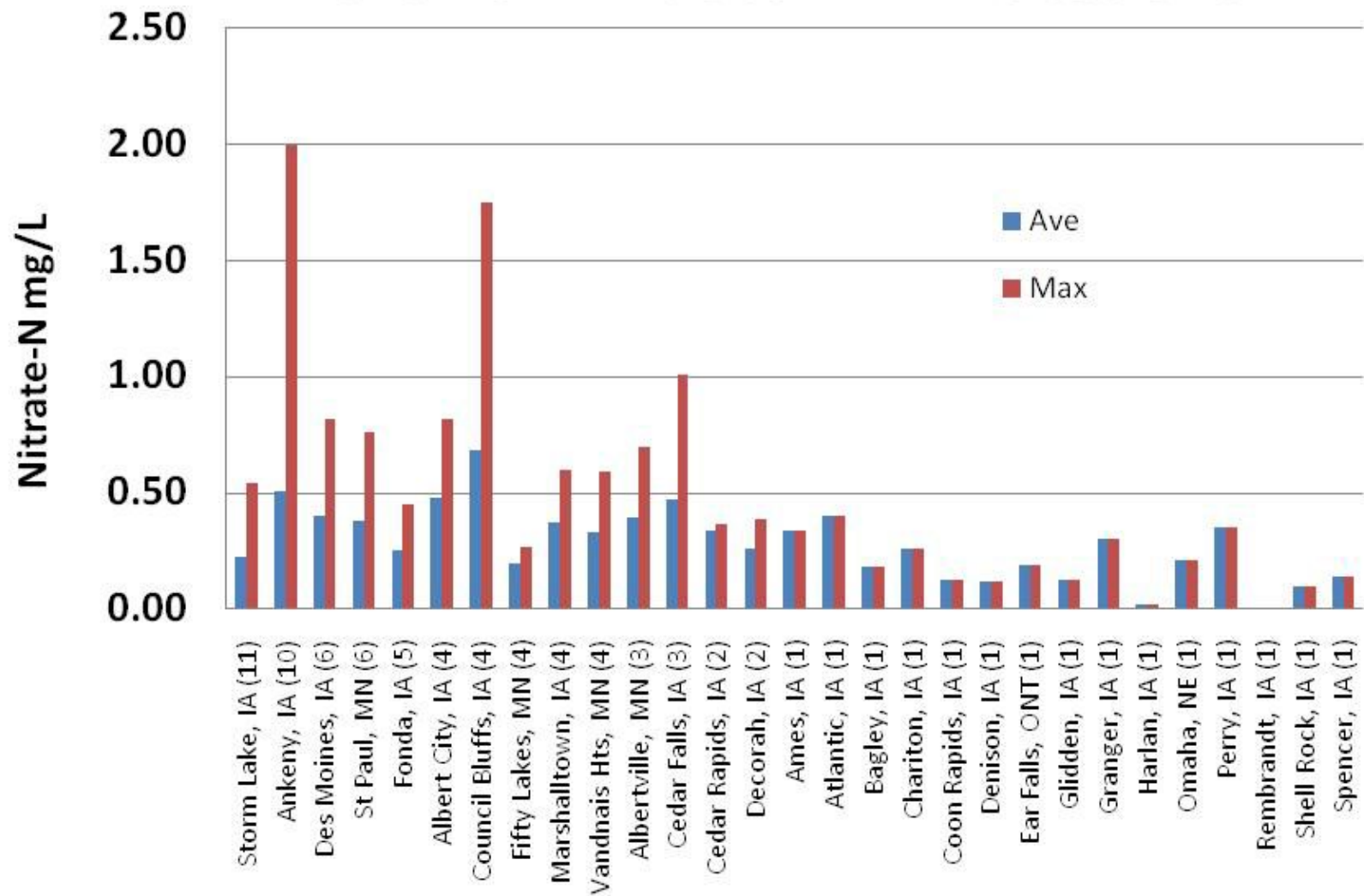


Ammonia-N in Melted Snow, mg/L

0.07: Ear Falls, ONT



2010-2011 Nitrate-N in Melted Snow



Co-authored Research Papers

by Bill Schlesinger, Cary Institute for Ecosystem Studies.

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- “Effects of Agriculture upon the Air Quality and Climate: Research, Policy, and Regulations” (2009). *Environmental Science & Technology*, 43(12): 4234-4240. Co-authored with VP Aneja & JW Erisman.
- “Farming pollution” (2008). *Nature Geoscience*, 1: 409-411. Co-authored with VP Aneja & JW Erisman.
- “Ammonia assessment from agriculture: U.S. status and needs” (2008). *Journal of Environmental Quality*, 37: 515-520.

Authored Research Papers

by Bill Schlesinger, Cary Institute for
Ecosystem Studies.

37

- “On fertilizer-induced soil carbon sequestration in China’s croplands” (2010). *Global Biology Change*, 16: 849-850.
- “On the fate of anthropogenic nitrogen” (2009). In *Proceedings of the National Academy of Sciences of the United States of America*, 106(1): 203-208.

Thoughts of Bill Schlesinger:

- Schlesinger thinks that national arguments over climate change have allowed the U.S. to ignore the nitrogen problem, which he predicts will be the next big environmental issue.
- “It’s another example of humans upsetting global bio-geochemical cycles with unintended consequences,” he says.

Common Myths

1. “This is a valuable manure.” It is not!

- Today waste sits and “cooks” (anaerobic digestion) for months in pits, tanks, or lagoons, constantly generating and sending poison sewer gases and particulates into the surrounding neighborhood and larger environment. And it becomes toxic before being applied to fields.
- For thousands of years, manure used to be deposited directly to the land by animals, or frequently spread by farmers. It broke down into its constituent parts within a few days.

- Relative pollution numbers:

	Treated Human Waste	Raw Human Waste	Confinement Waste
CBOD	25	200	1000
TSS	30	200	1000+
Ammonia/Nitrogen	1-5	15-20	300-400

- **Because** hog manure is five times more polluting than human waste, and **because** we have ~20 million hogs at any one time being raised in the state, **it is like having 100 million people** in Iowa having their waste collected but not treated and spread directly onto the land, and calling it valuable manure.

Common Myths continued...

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2. **“The odor is merely a nuisance, with no health problems.”**

There ARE health problems. Studies have shown significant increases in respiratory ailments in neighbors of confinements, including asthma from ammonia exposure, in central nervous and digestive system ailments from hydrogen sulfide exposure, and the drug-resistant organisms problem.

3. **“Technology can fix any problem.” No, it can't.**

- Any time there is fecal waste decomposing in a pit, there must be poison gases being produced. If you use this technology, this will happen.
- These problems are prior to and separate from any treatment.
- Because people and animals are in proximity to the pit, there is no technological fix.

4. **“Confinements and feedlots are regulated.” Not really.**

- The only rules are about where waste may be spread.
- There are no wastewater regulations.

5. **“Opponents are urban activists.” They are not.**

- In our 20 years going to many counties in Iowa, we’ve learned that most opponents are farmers, farm wives, children and farm widows.
- Rural neighbors of CAFOs are most affected. Many CAFOs are built close to neighbors.
- Most CAFOs are not associated with what we would consider a farmstead.

6. **“We must keep this model because it gives us cheap food.” It does not.**

- Government subsidies and the **externalization** of soil loss, pollution and human health costs make this model cheap.
- A model that poisons and pollutes poses moral/ethical questions, which cannot be reduced to monetary figures.

In this presentation we have discussed:

- myths,
- the technology,
- inherent industrial poisons,
- explosive conditions in confinements,
- effects on people's health, and
- how people can be protected from this wastewater technology's harmful effects.

We have avoided:

- emotional arguments about animals,
- the treatment of animals,
- private property, and
- models of agriculture.

We have simply addressed the **interface** between **industrial poisons** and the **public**.

SCHOOL
ZONE
10 MPH

NO
THRU



- This is a local problem.
- This is a national problem.
- There is no technological fix.
- To clean up air, water, and soil, put animals back on the land.

Thank you

Questions?

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