

Environmental Concerns around Spray Manure Irrigation and Regulatory Perspectives

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What is a CAFO?

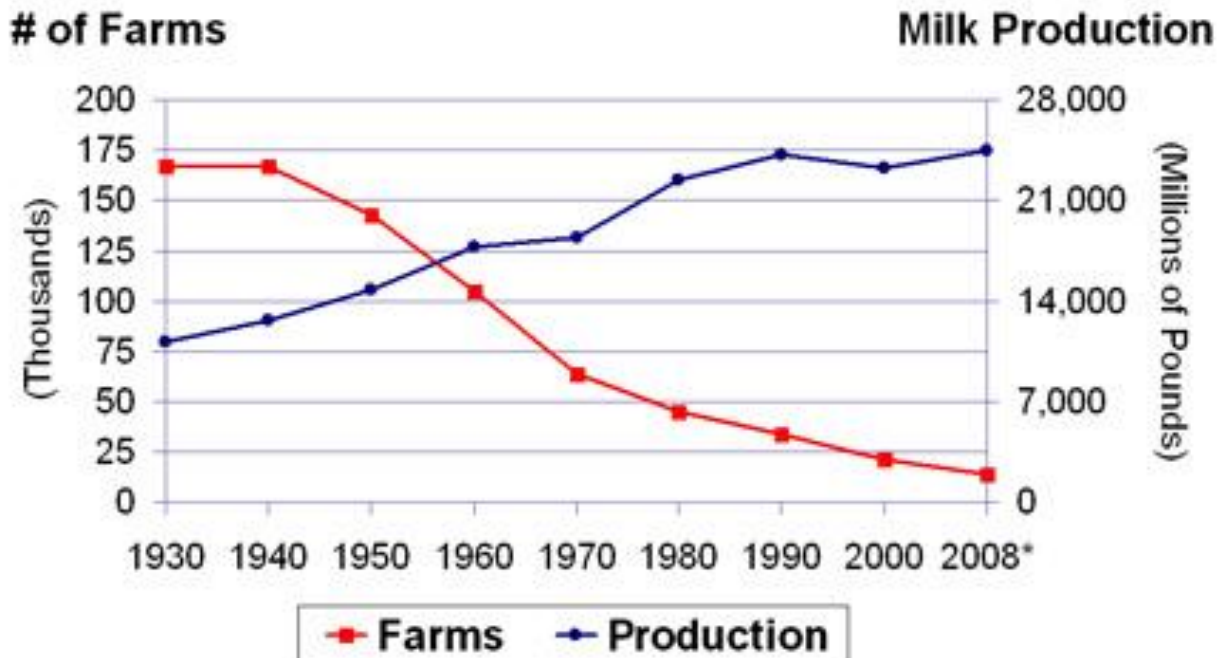
- **Animal Feeding Operations (AFOs):** animals are kept and raised in confined situations.
 - Feed, manure and urine, dead animals, and production operations on a small land area.
 - Animals confined at least 45 days in a 12-month period
 - No grass or other vegetation in the confinement area
- **Concentrated Animal Feeding Operations (CAFOs)**
 - AFOs that meet certain EPA regulatory definitions.
 - CAFOs 15 percent of total AFOs.

Problem: Animals wastes also concentrated



- Cows produce about 40 times as much body waste as people, but due to human water usage, farms produce 3 times as much waste water as humans
- Waste handling and storage
- Waste hauling and spreading
- public road traffic & damage
- nutrient management
- groundwater & runoff
- Land available for manure spreading major limitation to growth
- Nuisance odors and air quality
- Enjoyment/use of neighboring property/flies
- Changing rural character
- Feed/silage storage and handling, leaching

WI Dairy Farms & Milk Production, 1930-2008*



*Preliminary estimate.

Source: USDA/NASS, *Milk Production*.

 WISCONSIN MILK
MARKETING BOARD
WISCONSIN DAIRY PRODUCERS

Traveling Gun

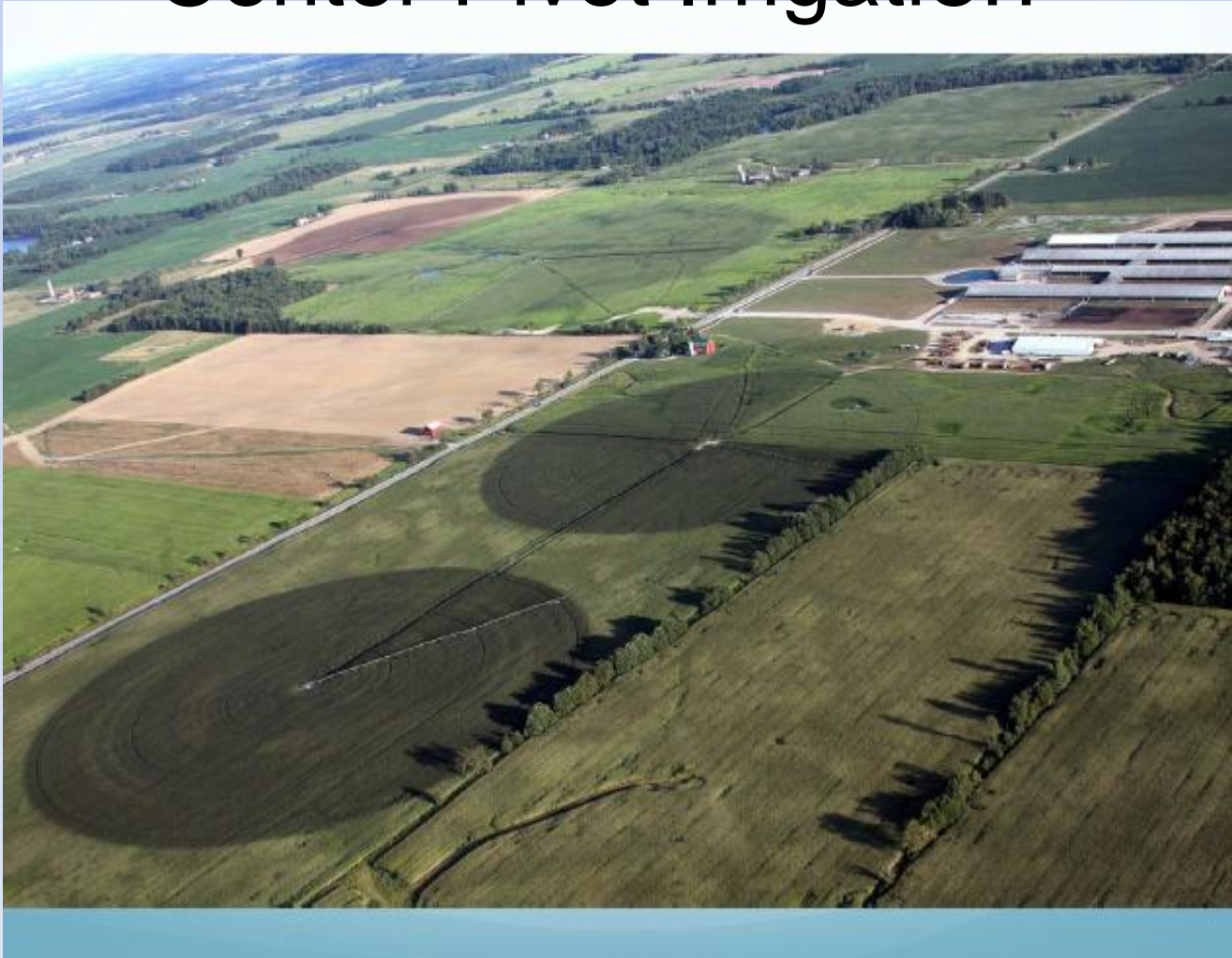








Dilute wastewater can be used with Center Pivot Irrigation







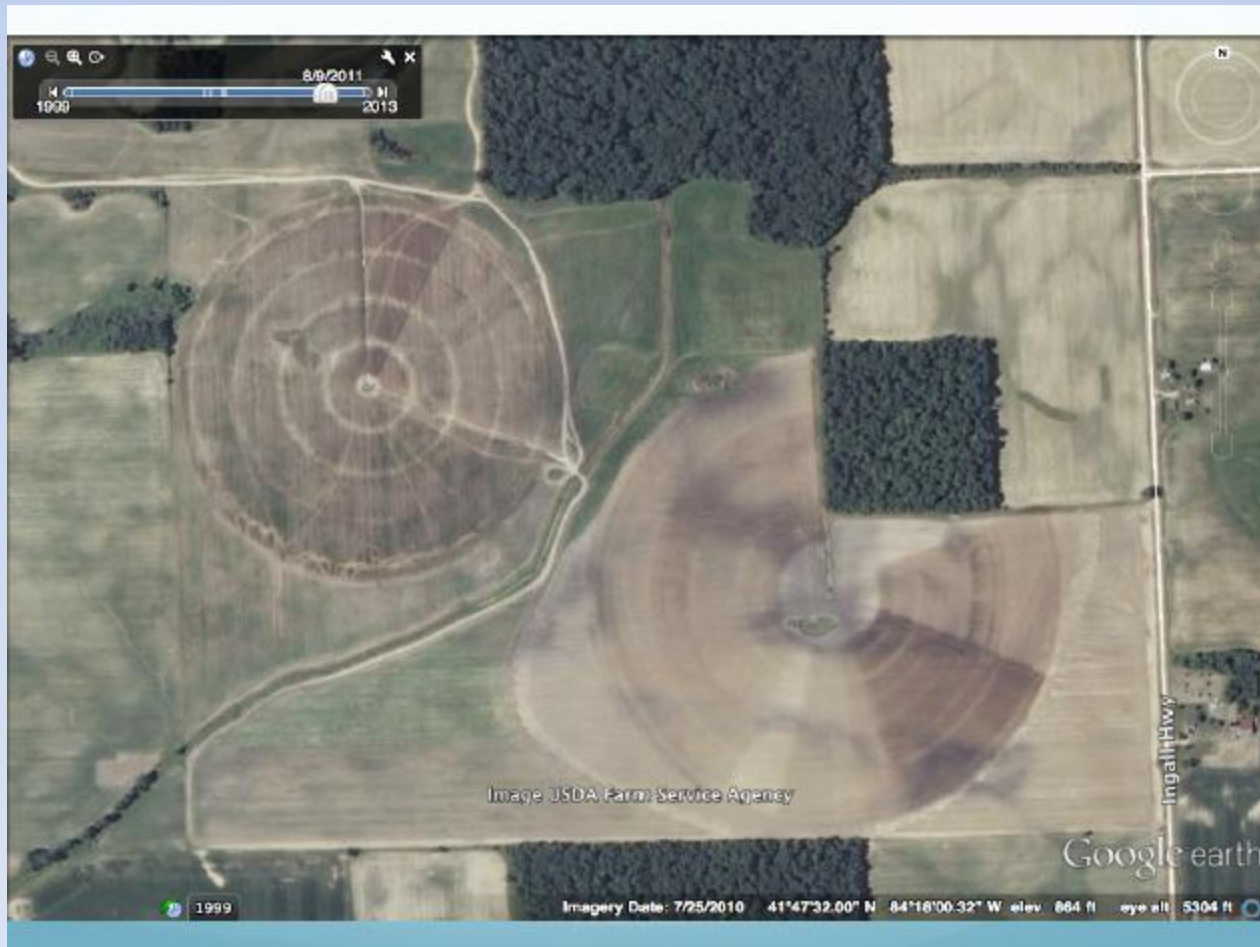


Image USDA Farm Service Agency

Google earth

1999

Imagery Date: 7/25/2010 41°47'32.00" N 84°18'00.32" W elev. 864 ft eye alt. 5304 ft





DROP NOZZLES

greatly reduce drift





End Guns increase drift









Chemicals Found in Manure

- **Hydrogen Sulfide**
- Methane
- Nitrogen Heterocycles
- Mercaptans
 - Methyl, Ethyl, Propyl
- Volatile Fatty Acids, Alcohols, & Aldehydes
- Organic Acids
 - Propionic, Butyric, Isovaleric, Isobutyric
- **Ammonia**
- Amines
 - Methyl, Ethyl, Dimethyl
- Carbon Dioxide
- Phenolics
- Sulfides
 - Dimethyl, Diethyl

Microorganisms of Concern

Cryptosporidium parvum

- Responsible (with *C. hominis*) for largest waterborne disease outbreak in US history
- Severe diarrhea 21 days median duration
- 7-22% of patients hospitalized

STEC Shiga toxin producing E. coli

- *E. coli* O157:H7, the Jack-in-the-Box bug
- Causes no disease in cattle
- Severe diarrhea; 4% of cases develop kidney failure

Salmonella enterica

- In people, diarrhea, cramps, fever
- Can move from the intestine to bloodstream, bone, and urinary tract

Campylobacter jejuni and C. coli

- Severe diarrhea, potential complications with liver, heart, other organs
- Causes Guillain-Barré syndrome, acute paralysis

Manure Irrigation Pros

- Reduce hauling costs and road damage impacts
- More flexibility/time to apply manure
- More Precise Nutrient Management
- Sources (N and P) timing and amounts
- Better surface and ground water protection
- Less risk for manure surface runoff
- Reduce leaching below root zone



Manure Irrigation Cons

- Possibility for increased odors and air emissions
- Increased drift risk compared to other manure application methods
- Possible health risk from air pathogens
- Inhalation
- Deposition on surfaces



Public Concerns about Spray Manure Irrigation

- Concerns that aerosol spray drift from manure irrigation could carry pathogens, particulates, antibiotics, endocrine disruptors, cleaning compounds, hydrogen sulfide and ammonia. These contaminants could affect the general population and especially the immune compromised and elderly; aerosols penetrate lungs and carry toxins to the bloodstream more directly than if ingested.
- Quality of life concerns, reinforced by reports from people with complaints of worsening respiratory health, poor air quality, increased airborne particulates, odor, and contamination of their property as a result of nearby manure irrigation.
- The potential for contamination of surface water and wells from irrigation application, especially in areas where access to groundwater is more direct such as in sandy soil. There are concerns about runoff from precipitation events after manure irrigation application.
- Concerns that manure irrigation might use excessive amounts of groundwater resources and may draw down wells.
- Concerns that existing and future setbacks will be inadequate to protect neighbors, surface waterways, and crops in nearby fields.
- Organic farms are concerned about the risk of losing organic certification due to spray drift depositing materials on crops.
- There are concerns that monitoring implementation of manure irrigation practices would be difficult and impractical.

Manure Irrigation Considerations

- Drop nozzles and other equipment
- Drift based on physical properties of the droplet, large vs small droplet
- Wind breaks
- Irrigation rates, pressures
- Pathogen content and viability due to sunlight
- Alternative inexpensive monitoring
- Drift modeling and Risk Assessment
- Manure Treatment—dilution or separation
- Digester draws down microbial load but does not sterilize it



Reducing Manure Irrigation Risks

- DNR approval of manure irrigation fields via Nutrient Management Plan
- Operate in appropriate locations
- Management plans to minimize drift and pathogen survival
 - equipment types and operational methods
 - weather and other high risk conditions
 - monitor applications for drift
 - calibrate equipment
 - Treatment via Digesters/Separation
 - RESEARCH

Wisconsin Statute 823.08:

Right to Farm Law

An agricultural use or an agricultural practice may not be found to be a nuisance if all of the following apply:

- 1. The agricultural use or agricultural practice alleged to be a nuisance is conducted on, or on a public right-of-way adjacent to, **land that was in agricultural use without substantial interruption before** the plaintiff began the use of property that the plaintiff alleges was interfered with by the agricultural use or agricultural practice.
- 2. The agricultural use or **agricultural practice does not present a substantial threat to public health or safety.**

CAFO Regulatory Control

State level

- NR 243 Animal Feeding Operation
- NR 445 Hazardous Air Pollutants
- ATCP 50 Soil & Resource Mgmt Program
- ATCP 51 Livestock Siting Rules
- NRCS (Natural Resource Conservation Service) Standards
- Right to farm law

CAFO's must comply with NR 243 and NR 214 setback requirements:

- 25 to 100 feet from navigable waters and conduits
NR 243
- 500 feet from homes (from nearest edge of application. Greater distance may be required depending upon distribution system and potential for public health impacts) NR 214
- 250 feet from drinking water wells NR 214
- 1000 feet from municipal wells NR 214
- 5 feet separation from bedrock and groundwater
NR 214
- 100 feet from direct conduits to groundwater
NR 243

NR 243: CAFOs

- DNR rules for protection of groundwater and surface waters near CAFOs.
- Regulates storage and spreading of manure
 - Liquid manure winter restrictions
- Requires nutrient management plans
- Rainfall events defined by county
- Animal equivalency units defined

NR 445 regulation of Hazardous Air Pollutants

- Hydrogen Sulfide and Ammonia are identified as most significant HAPs emitted from CAFOs
- *Many* other chemicals contribute to odor
- Microbial activity in stored manure contributes to odor
- Manure differs among swine, cattle, poultry
- Wisconsin NR 445 standards:
 - Ammonia: 100 $\mu\text{g}/\text{m}^3$ annual; 418 $\mu\text{g}/\text{m}^3$ 24 hr (597 ppb)
 - OSHA PEL 50 ppm
 - Hydrogen Sulfide: 335 $\mu\text{g}/\text{m}^3$ 24 hour (240 ppb)
 - OSHA 10 minute 50 ppm

Does Anaerobic Digested Manure have Reduced Health Risks?

Findings and perspectives to keep in mind...

- Pathogen types and concentrations in manure (i.e., the herd) are highly variable over time
- Pathogen inactivation by anaerobic digestion is highly variable
- Because pathogen concentrations in manure can be very high, a 99% reduction (i.e., 2-log removal) does not mean pathogen levels become low
- 99% of the pathogens in the digestate after separation partition into the liquid fraction
- Digesters are designed to produce methane, not inactivate pathogens

Other Public Concerns—Spills

Here are two examples of recent spills.

Fond du Lac County had a 50,000 gallon manure spill in spring 2014 that got into Pipe Creek and then Lake Winnebago – residents were upset. A manure contractor was piping the liquid manure and a hose broke early morning.

There are built in backups to prevent spills, however those backups failed. Systems, equipment, and monitoring data are to be monitored. The hose had a break and the break was pointing downward into the ground. It was dark and the spill was not noticed until the sun came up. A small break in the line/hose is supposed to cause the hose to burst open and a pressure drop – the hose did not split open and workers did not report a pressure drop.

Dane County had two spills at the same farm. The first one was a 300,000 gallon spill at 11:00 pm so no one was onsite to stop the flow. The second one was a 20,000 gallon spill on January 22, during the day so the staff stopped it quickly. Both were the result of vibration from the operation causing joints to break and the subsequent release. The spill had potential to impact the ditches, farm fields, and creeks in the Lake Mendota watershed. Booms and pumping trucks were used to contain the spill and prevented a release to the lake. The system was repaired to prevent future spills.

Role of state and local Health Departments in CAFO Issue

- Help Citizens Find Safe Drinking Water
- Provide Well Water Test Kits
- Advise Citizens on Test Results
- Develop/ Maintain Ground Water Data Base of Area wells
- Coordinate with WDNR & DATCP
- Air monitoring in limited cases

Summary of key points:

The problem with new large consolidated agriculture is the consolidation of waste as well. Nitrate contamination of groundwater is a concern throughout Wisconsin.

Spray Irrigation occurs more frequently in lesser amounts to allow nitrates to infiltrate into plants rather than the groundwater.

A cow produces 37 times more waste than a human, though humans use additional water throughout the day.

Key is to have enough land surrounding a CAFO to accommodate the storage and handling of waste.

Right to farm law does not allow the Health Department to intervene solely on the basis of a nuisance.

The Manure Irrigation Workgroup is conducting field studies to better understand the drift and viability of microorganisms.

New techniques need to be devised to store and dispose of waste.

Resources and Credits

This presentation was developed with materials from the *Understanding Manure Irrigation* workgroup website. For more information please visit the site.

<http://fyi.uwex.edu/manureirrigation/>

Additional information on spray manure irrigation can be found on the Wisconsin Department of Natural Resources website.

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