



Considerations for the Use of Manure Irrigation Practices

Report from the Wisconsin Manure Irrigation Workgroup

Report Introduction and Overview Webinar

April 14, 2016



Your Presenters



Dr. Ken Genskow, UW-Madison/Extension,
Associate Professor in the Department of Urban
& Regional Planning and Extension specialist



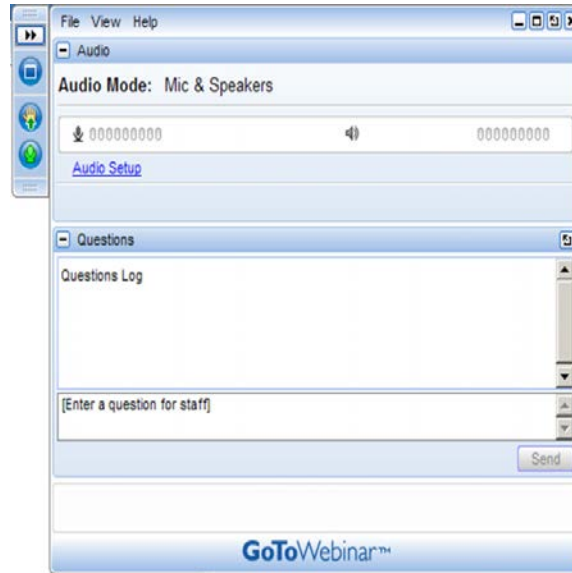
Dr. Becky Larson, UW-Madison/Extension,
Assistant Professor in the Department of
Biological Systems Engineering and Extension
specialist



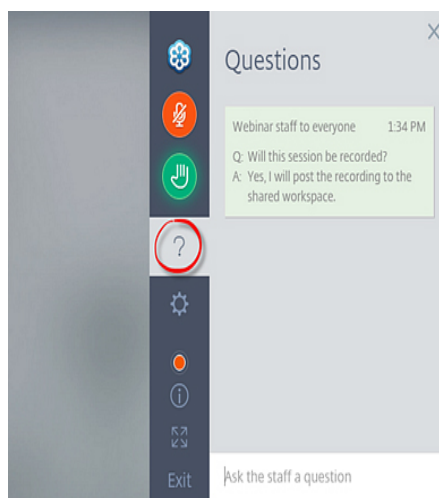
Dr. Mark Borchardt, USDA-ARS,
Research Microbiologist

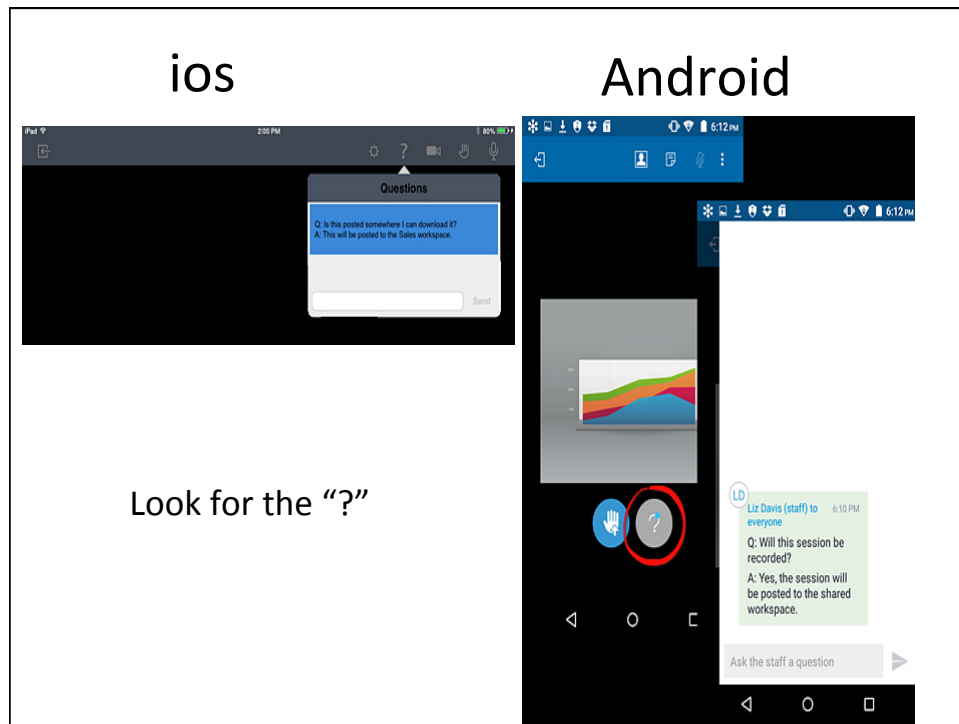
You may submit questions at any time

Desktop
Application



web browser





Today

- Overview of Manure Irrigation Workgroup and Report Outline
 - Ken Genskow, UW-Madison/Extension
- Review of manure irrigation practices and issues
 - Becky Larson, UW-Madison/Extension
- Summary of airborne pathogen drift study
 - Mark Borchardt, USDA-ARS
- Overview of workgroup recommendations
 - Ken Genskow, UW-Madison/Extension

Questions: ~ 30 minutes



Manure Irrigation Workgroup

Purpose:

Review issues and develop guidance on the practices of applying livestock manure or process wastewater through irrigation equipment


Audience:

- State and local agencies and officials
- Interested/concerned stakeholders
- Producers interested in the practices



Manure Irrigation Workgroup

- Scope of review:
 - benefits,
 - concerns,
 - remaining questions
- Decisions: Consensus seeking
- Product: guidance and recommendations for stakeholders and those interested in establishing policy – local and state officials.
- Workgroup had no formal authority to establish policy



Manure Irrigation Workgroup


Composition:

UW-Madison/Extension (3)	County Health Departments (2)
USDA-ARS (1)	Dairy Farmers (3)
USDA-NRCS (1)	Professional agronomist (1)
WDNR (2)	Nutrient applicator (1)
WDATCP (1)	Organic Farmer/concerned citizen (1)
WDHS (2)	Wisconsin Land+Water Assoc (1)

Public Forums May 2013


Workgroup meetings: July 2013 – September 2015 (16 meetings)

Concurrent pathogen drift study by USDA-ARS & UW-Madison: 2013-2015



Identified for Workgroup

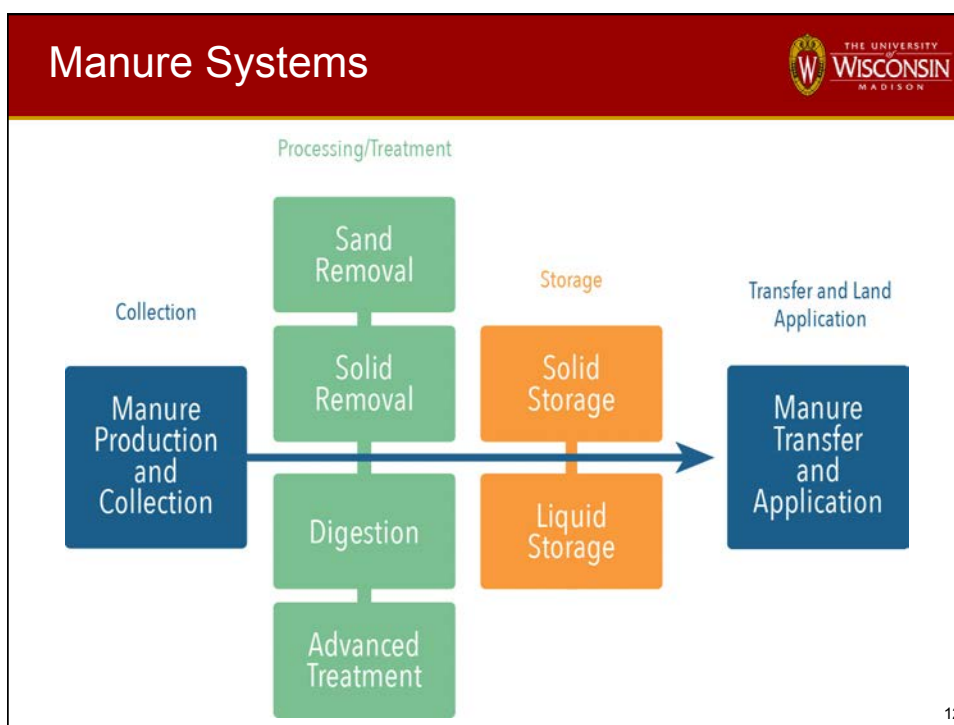
<p><u>Concerns</u></p> <ul style="list-style-type: none">• Public health risk from airborne pathogens and other contaminants• Drift• Odor and other quality of life concerns• Surface water quality• Groundwater• Implementation and compliance	<p><u>Benefits</u></p> <ul style="list-style-type: none">• Timing of manure application• Road safety and reduced road damage• Farm management and economic benefits
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Workgroup Report

1. Introduction
2. Manure content, management, and current regulations
3. Considerations for manure irrigation practice
 - a. Droplet drift
 - b. Odor
 - c. Water quality
 - d. Air quality
 - e. Airborne pathogens
 - f. Timing
 - g. Other management issues
4. Scenarios
5. Response & recommendations

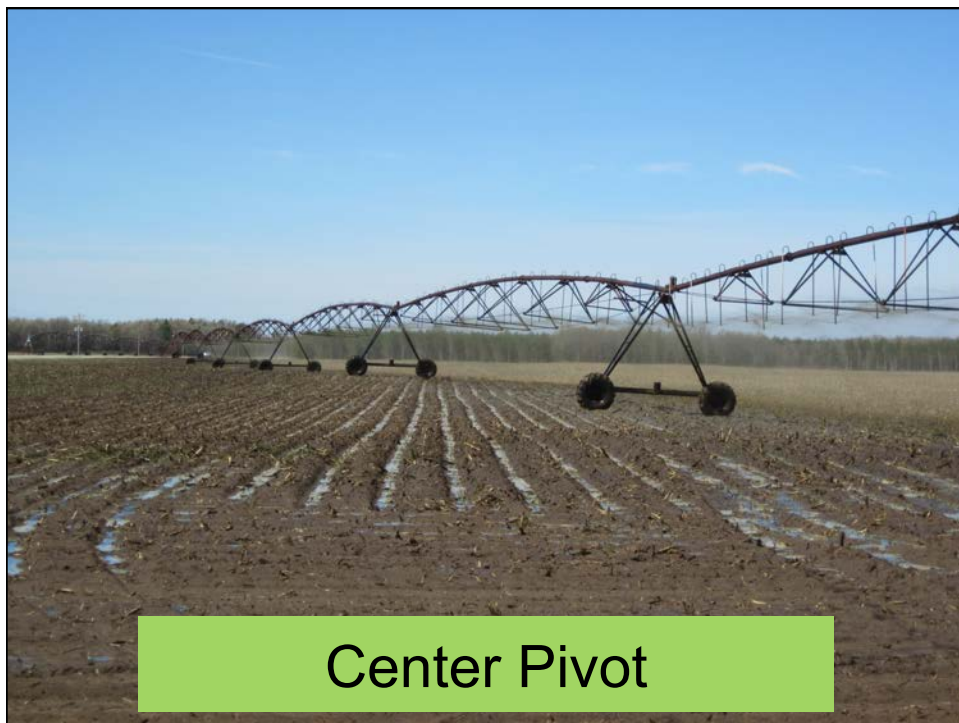
Appendices – including pathogen drift study expanded summary



Manure Application Methods



Wisconsin Manure Irrigation Workgroup Report
Webinar Presentation – April 14, 2016



Center Pivot

Wisconsin Manure Irrigation Workgroup Report
Webinar Presentation – April 14, 2016



Wisconsin Manure Irrigation Workgroup Report
Webinar Presentation – April 14, 2016



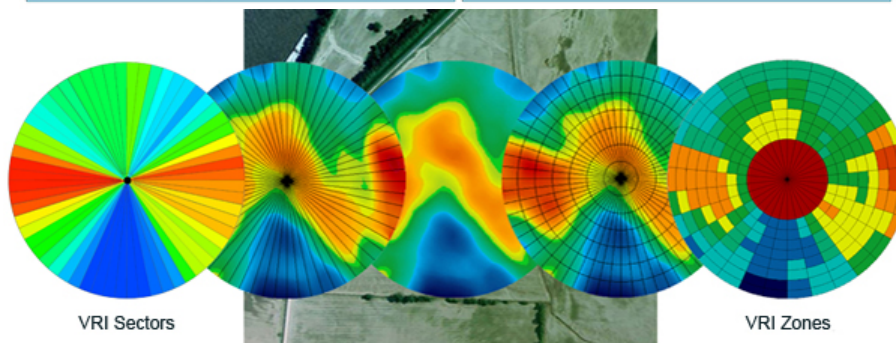
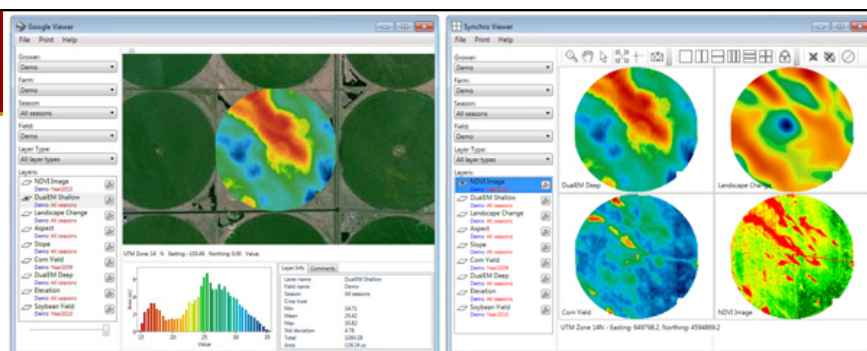
Operation



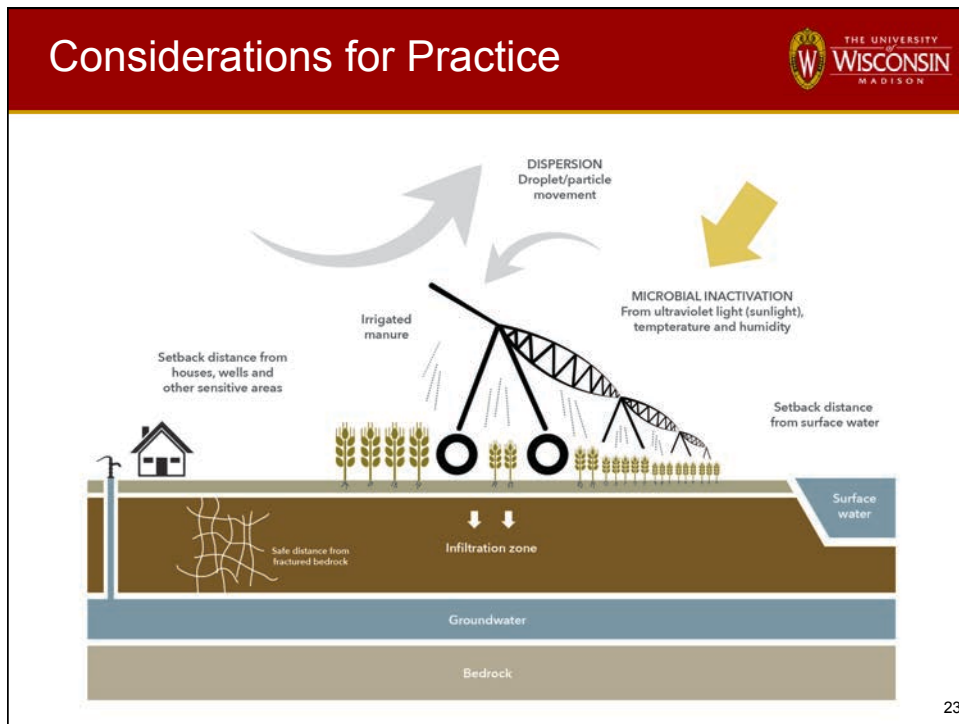
Can control many pieces on the system:

- Speed of travel
- Pressure
- Nozzle type
- End gun shut off
- Computerized systems which detect wind speed, etc.
- More specialized application

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<http://cropmetrics.com/features/variable-rate-irrigation/>



Drift

- Aerial movement of liquid outside the intended application area
- Different than overspray
- Concerns for surface waters, residences, public areas, other crops, etc.
- No regulations for other manure application methods
- Drift from manure irrigation can be minimized by:
 - Maximizing droplet size
 - Minimizing release height (e.g. drop nozzles)
 - Minimizing wind speeds
 - Using barriers (e.g. tree lines)



Odor



- Odor perception is variable
- Manure odors can be from 300+ compounds
- Great citizen concern for odors produced
- Odor will be generally be greater for manure irrigation systems compared to other application methods
- Odor mitigation
 - Dispersion (winds greater than 5mph)
 - Edge of field barriers
 - Consideration of neighbors
 - Proximity to receptors
 - Manure processing
 - Large droplets



Water Quality



- Concerns for runoff and impact to groundwater
- May decrease runoff and leaching due reduced volume applied for each application period
- Need to apply to current regulations including NRCS CPS 590
- Issues with compliance/ monitoring and enforcement



<http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1088801071&topicorder=14&maxto=16>

Air Quality



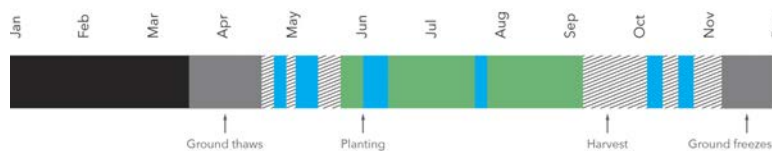
- Issues of concern include
 - Particulate matter
 - Greenhouse gas emissions
 - Hazardous air pollutants (including ammonia and hydrogen sulfide)
- OSHA Occupational Standards and Wisconsin Ambient Air Standards
- Field concentrations of many hazardous air pollutants are below standards (more of a concern at the farmstead near the manure storage)
- Mitigation techniques
 - Edge of field barriers
 - Large droplets
 - Low release height

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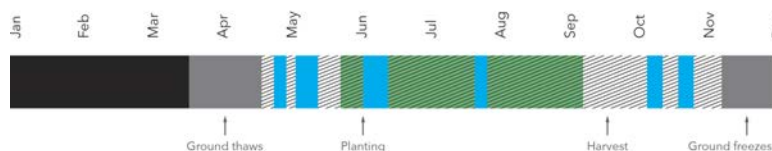
Application Timing



Without Irrigation



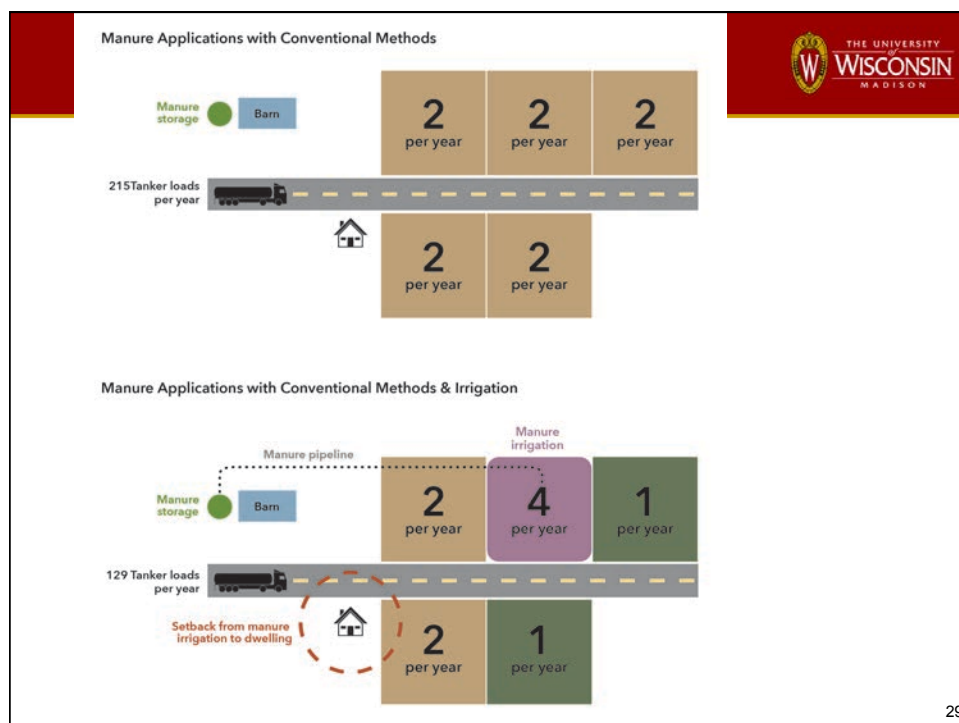
With Irrigation



Color Key:

■ Frozen soils ■ Growing season ▨ Manure application allowable ■ Precipitation ■ Growing season

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Quantitative Microbial Risk Assessment for Estimating Setback Distance from Aerial Irrigation of Dairy Manure

Mark Borchardt, Tucker Burch, Susan Spencer,
USDA – Agricultural Research Service

Joel Stokdyk and Aaron Firnstahl
US Geological Survey Wisconsin Water Science Center

Becky Larson, Dept Biological Systems Engineering UW-Madison

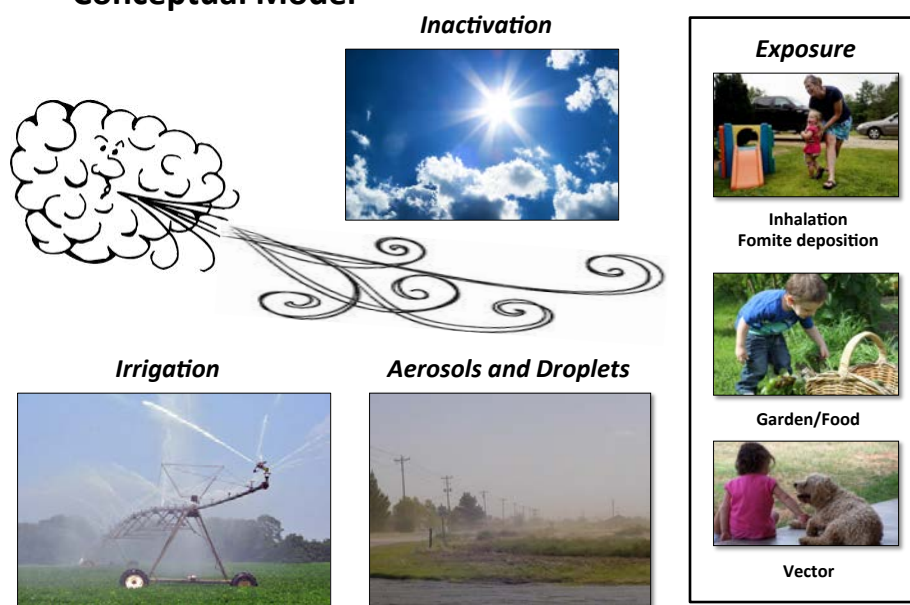
Burney Kieke, Marshfield Clinic Research Foundation

Ana Rule, Bloomberg School of Public Health, Johns Hopkins University

Project Objectives

1. Identify the risk of acute gastrointestinal illness from airborne pathogens during manure irrigation. Relate risk levels to distance from irrigated manure.
2. Identify other variables (e.g., weather conditions) most important for airborne pathogen transport during manure irrigation

Conceptual Model



Research Approach

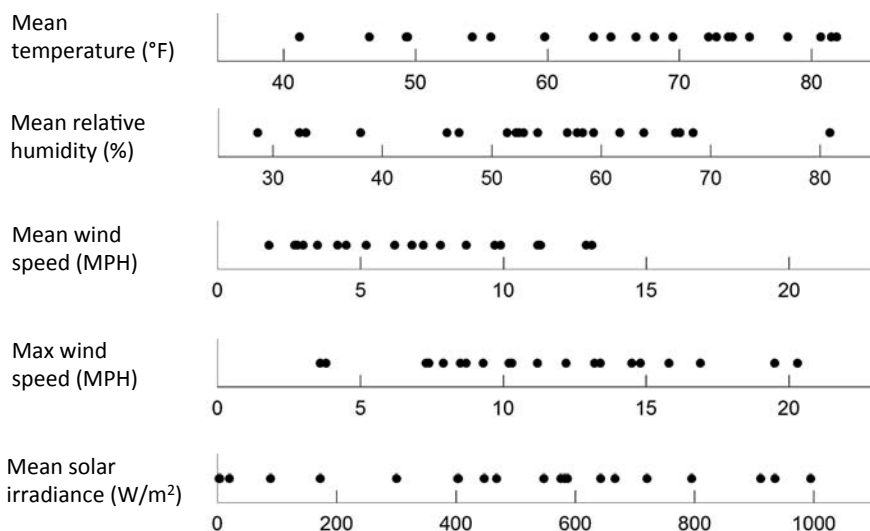


Research Approach



- 25 field trials
 - 15 traveling gun, 8 center pivot, 2 tanker
- Measured microbe concentrations in manure and at multiple distances for each trial
 - qPCR and culture
- Collected weather data for each trial

Weather Conditions during Manure Irrigation Trials



Gram-Negative Bacteria in Air During Travelling Gun Manure Irrigation

May 22, 2014; 11 mph wind; 530 W/m² solar irradiance; 50% relative humidity; 68 °F temp



Notes

- MacConkey agar in Anderson samplers
- Air sample volume was 540 liters
- Downwind distances were perpendicular to gun movement
- Manure diluted 1:100 before plating 100 µl

Research Approach



- Statistical modeling (i.e., regression)
- 2 objectives:
 - Predict air concentrations for risk assessment
 - Relate air concentrations to weather conditions and microbe concentrations in manure

Research Approach



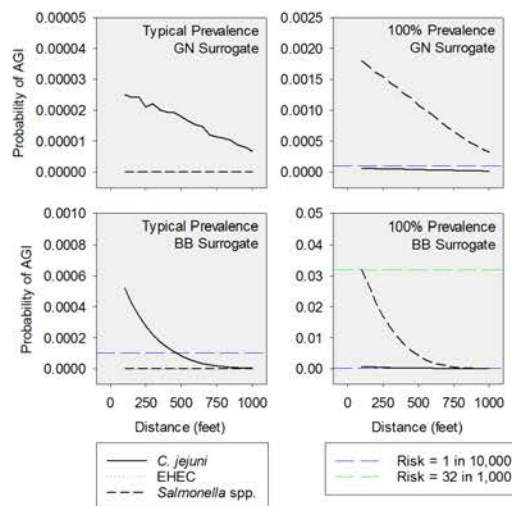
- Statistically most important variables:
 - Distance from irrigated manure
 - Wind speed
 - Pathogen concentrations in manure

Research Approach



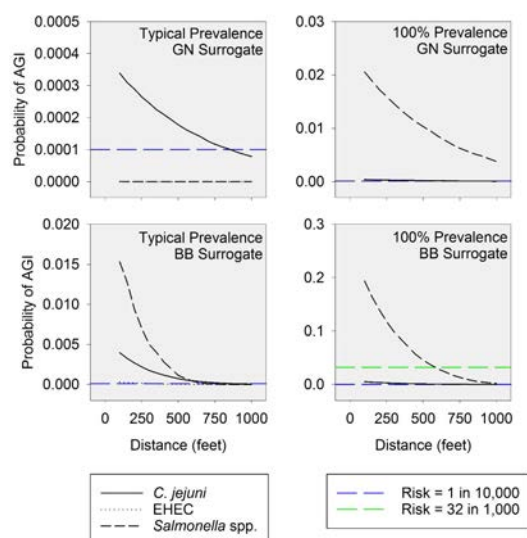
- Quantitative microbial risk assessment
 - Predictive alternative to epidemiology
 - Relies on dose-response models
- Inputs: pathogen prevalence, distance, age, inhalation rate, time spent outdoors
- 2 pathogen surrogates: bovine *Bacteroides* and gram negative bacteria

Risk vs. Distance Median of the Risk Distribution



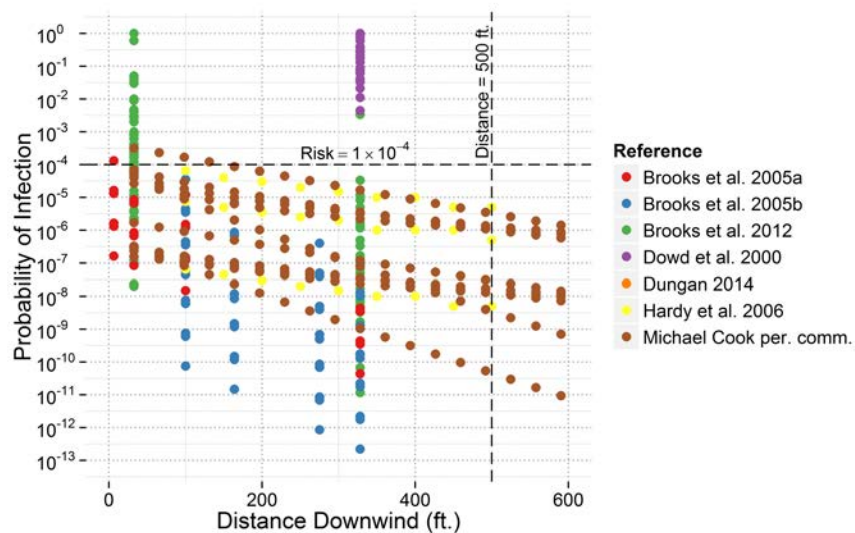
AGI: acute gastrointestinal illness, GN: gram negative bacteria, BB: bovine *Bacteroides*

Risk vs. Distance 75th Percentile of the Risk Distribution

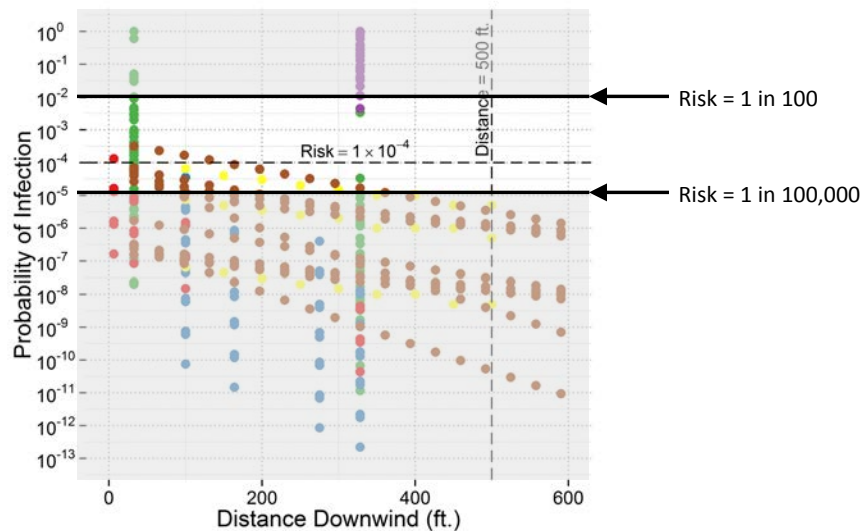


AGI: acute gastrointestinal illness, GN: gram negative bacteria, BB: bovine *Bacteroides*

Previous Risk Assessments



This Study's Risk Estimates Relative to Previous Risk Assessments



Summary

- At 500 feet downwind from dairy manure irrigation illness risk is on the order of 1/100,000 to 1/100 per irrigation event
- Risk depends on pathogen type, pathogen prevalence, downwind distance, and the number of irrigation events
- Pathogen air concentrations downwind from manure irrigation depend on wind speed, pathogen concentrations in manure, and distance
- This study is unique for using field data and state-of-the-art statistical modeling and risk assessment methods


Acknowledgements

- We thank ...
- Jan Altmann, Jordan Gonnering, Hana Millen and Zach Zopp for field and laboratory work
- John Panuska for contributions to the study design
- Scott Fischer and owners and staff of participating dairy farms
- Philip Schmidt, Peter Teunis, and Norval Strachan for dose-response parameter distributions
- This study was funded in part by the Wisconsin Department of Natural Resources



Workgroup Recommendations


- Multiple meetings
- Consensus seeking
 - Consensus: unanimous agreement – could “live with”
 - Near consensus: high level of agreement (all but 1 or 2)
 - Close to near consensus: a few not in agreement
 - No agreement: broader disagreement



Consensus Baseline Recommendations

If using manure irrigation, in all cases must:

- Follow all existing laws for animal waste and nutrient management
- Have and follow 590-standard Nutrient Management Plan
- Take appropriate steps to minimize drift
- Ensure no overspray of irrigated manure
- Have suitable means of supervising/controlling equipment
- Have suitable means of determining relevant weather info
- Have means of preventing backflow if connected to water
- Ensure no human waste or septage is processed with manure

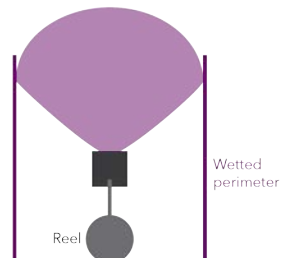


Consensus Recommendations (continued)

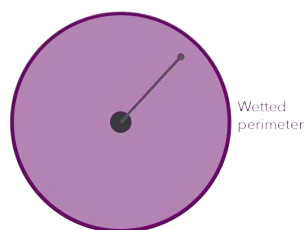
- Determine wind speed as 15-minute mean at field
- Drop nozzles if center pivot
- Nozzles and pressures for “coarse” or larger droplet sizes
- All applications and setbacks in accordance with 590-NMP
- No more than 8 irrigated applications to any 1 field per season
(with potential for more if treated with acceptable technology)

Wetted Perimeter

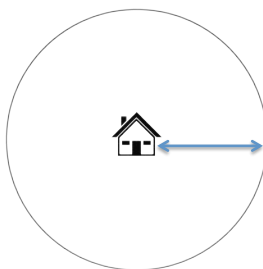
Traveling gun



Center pivot

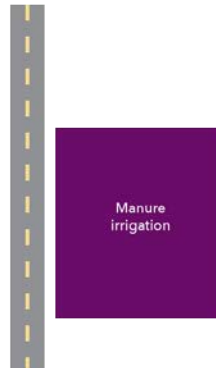


Setback Distance



Minimum distance from
wetted perimeter

Setback – Road Right-of-Way



0 feet: Near consensus, all types of roads and highways

Setback – Forests



0 feet: Consensus, public forests with no recreational access

0 feet: Near consensus, private forests

Setback – Adjacent Ag Properties



0 feet: Near consensus – pasture and crops that are not organic or raw consumed

0 – 50 feet: Close to near consensus – regardless of crop

Setback - Dwelling



500 – 750 feet: Near consensus, under various conditions for wind speed and direction

250 feet: Close to near consensus, for some situations; no agreement for others

Setback– Property Line for Public Recreation Area, School, Playground




100 feet: Near consensus, IF wind-speed ≤ 10 mph AND
parallel or away from property line
Other distances: No agreement

Night-time Application

Consensus: NOT for raw/untreated

Near consensus: same as daylight IF manure treated AND wind-
speed ≥ 2 mph but ≤ 10 mph AND wind is parallel
or away from building or property line



Next Steps

Short term:

- Next 30 minutes: Questions from today's presentations
- Next 4-5 weeks: Questions/comments submitted via the manure irrigation workgroup website
- Week of May 16: Webinar #2 – Responding to questions
- FAQ document

Beyond:

- Potential for shared website with links to new research
- Local discussions and decisions around these practices
- Potential future forum



Thank You



CONSIDERATIONS
FOR THE USE OF
MANURE IRRIGATION
PRACTICES

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Report available soon after the webinar ends at:

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