Meeting Summary

Agricultural Best Management Practices Technical Workgroup
Wednesday, November 4, 2009, 1:30 p.m.
Arizona Department of Environmental Quality
Conference Room 3175 A & B
1110 W. Washington St., Phoenix, Arizona 85007

Discussion Points:

1) **Welcome; Introductions & Review of Agenda**
Co-chair Earl Petznick Jr. welcomed members of the Technical Workgroup to the meeting.

2) **Introduction of Dr. Brent Auvermann**
Bas Aja, Arizona Cattleman's Association introduced Dr. Brent Auvermann, Professor of Agricultural Engineering at the Texas AgriLife & Research Center at Amarillo, Texas.

3) **Presentation by Dr. Auvermann**
Dr. Auvermann presented information on PM_{10} emissions from feedlots. The presentation covered research on PM_{10} emissions in and near animal feedlots, control measures and their efficacy, and the objectives of any applied control measures.

4) **Discussion of BMP Development for Beef Feedlot Operations**
Bas Aja gave a brief overview of the draft beef feedlot BMPs. Mr. Aja indicated that a narrative is being developed for the draft BMPs and will be distributed shortly.

5) **Discussion of BMP Development for Dairy Operations**
Mike Billotte, United Dairymen of Arizona, provided a brief overview the draft dairy BMPs. He stated their recommendations were mostly derived from the San Joaquin Valley CMP Program.

6) **Action Items**
1. ADEQ will develop a table comparing the AgBMP Rule, Maricopa County Rule 310.10, San Joaquin Valley Rule 4550, Imperial County Rule 420, and South Coast Rule 403.
2. ADEQ to provide California's civil penalty statutes (pertaining to agriculture)
3. NRCS to provide information on BMPs/CMPs (carried action item from Oct. 21st meeting)
4. ADEQ will get more information on the status of new appointees to the AgBMP Committee.

7) **Adjournment**
Mr. Petznick adjourned the meeting at 3:40 p.m.

For additional information contact Corky Martinkovic, 602-771-2372 or dam@azdeq.gov; or Lisa Tomczak, 602-771-4450 or lt5@azdeq.gov

Odor, Dust and Gaseous Emissions

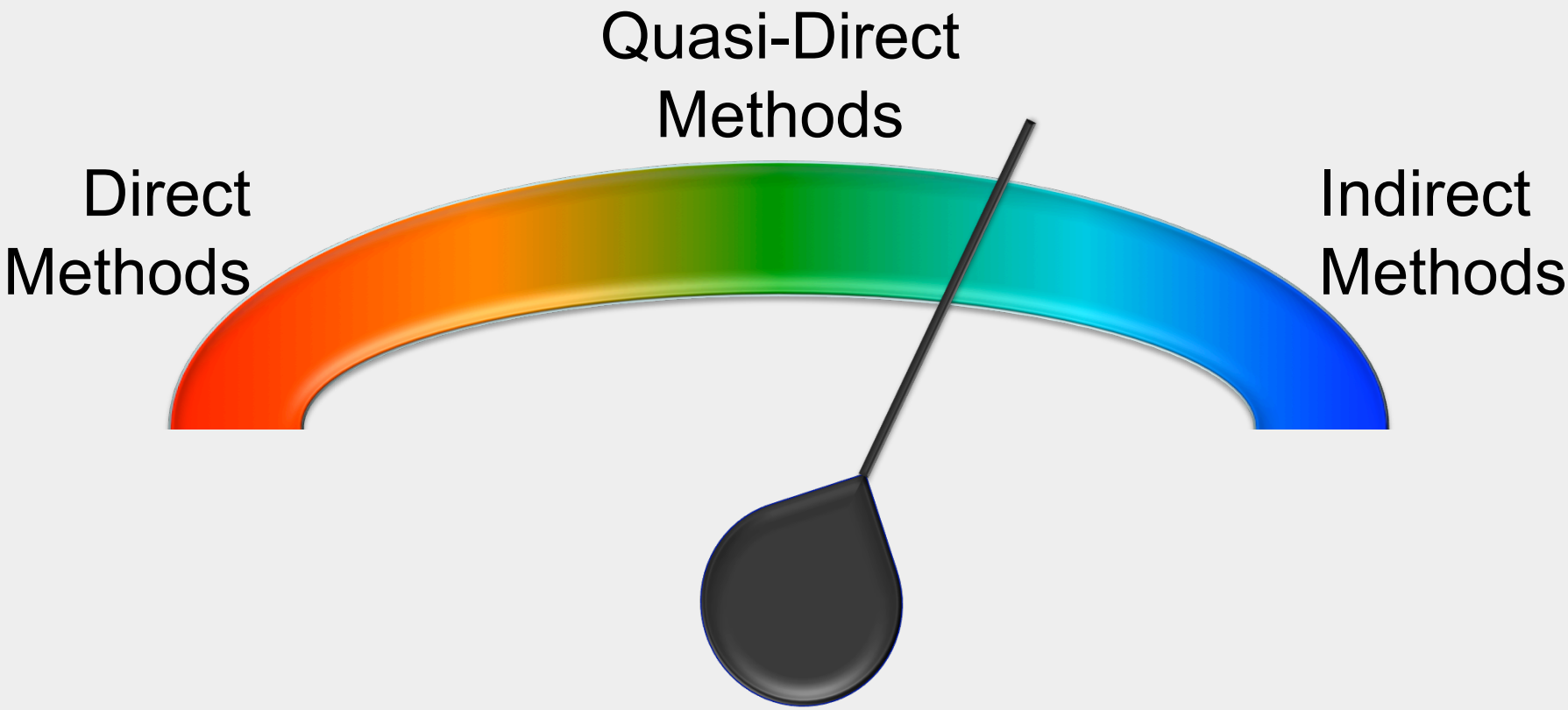
An agricultural research partnership of Texas AgriLife Research, WTAMU, Texas AgriLife Extension Service, KSU and USDA-ARS funded by USDA-CSREES (Award # 2005-34466-15703)

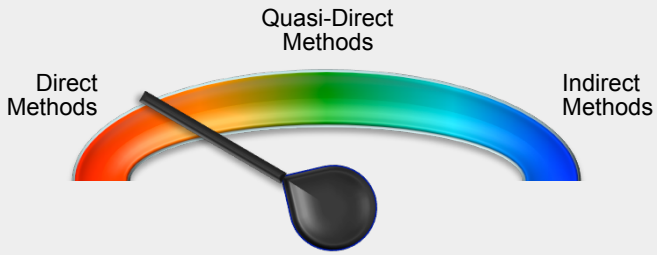
Measurements and Control Strategies

FUGITIVE DUST FROM CATTLE FEEDYARDS

Ground Level Area Sources

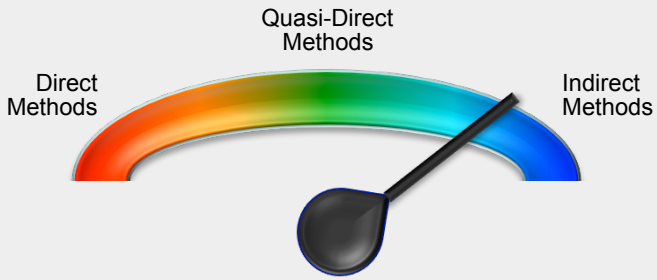
Measuring GLAS Emissions





Direct Methods

- Actually measuring the quantity of interest
- No such animal in the case of GLAS
- Methods that get closest:
  - Eddy accumulation
  - Flux chambers (!)



Indirect Methods

- Measuring something other than the quantity of interest (e. g., concentration)
- Inferring the emission rate from a model relationship
- Sensitive to errors in the measurements and the governing assumptions

$$Q = \frac{C}{AtmosphericDispersion}$$

PM_{10} Flux: Inverse Dispersion

- AP-42: 280 x (PM_{10}/TSP) = 70 lb/1,000 hd-d
- S. Parnell et al. (1994): 9.2 lb/1,000 hd-d
- C. B. Parnell et al. (1999): 15 lb/1,000 hd-d
- CARB (2004): 29 lb/1,000 hd-d
- J. Lange et al. (2007):
  - 16±8 lb/1,000 hd-d (ISCST3)
  - 11±5 lb/1,000 hd-d (AERMOD)
- Wanjura et al. (2004): 42 lb/1,000 hd-d
  - Pen surface: 6 (14%)
  - Unpaved roads: 36 (86%)

Summary

- Direct measurement of fugitive emission rates from GLAS is difficult & expensive
- Many indirect methods available; no single method is best for all scenarios
- *Model contingency raises red flags*
- *Multiple independent methods should converge on a narrow range of estimates*

PM_{10} Flux: Other Methods

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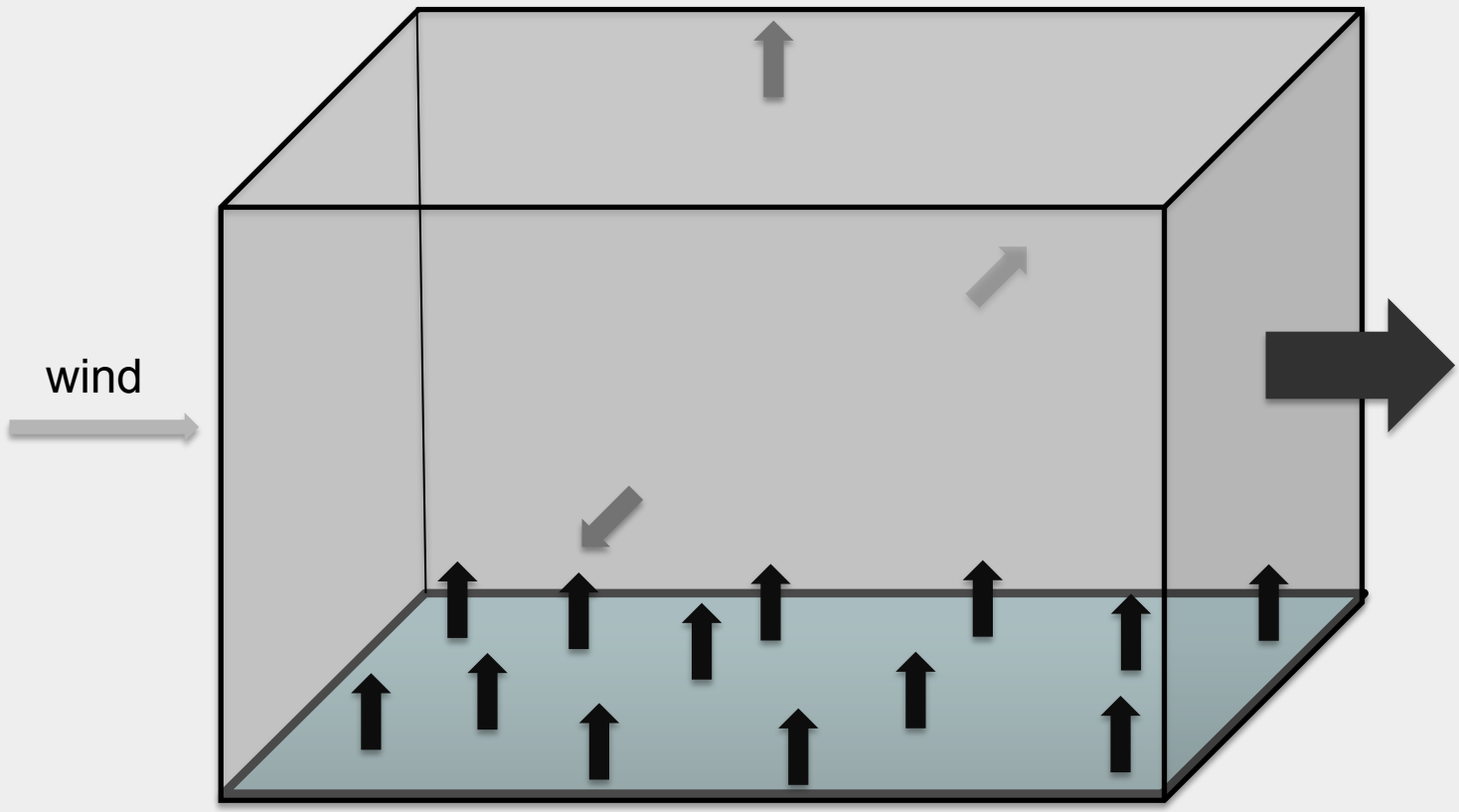
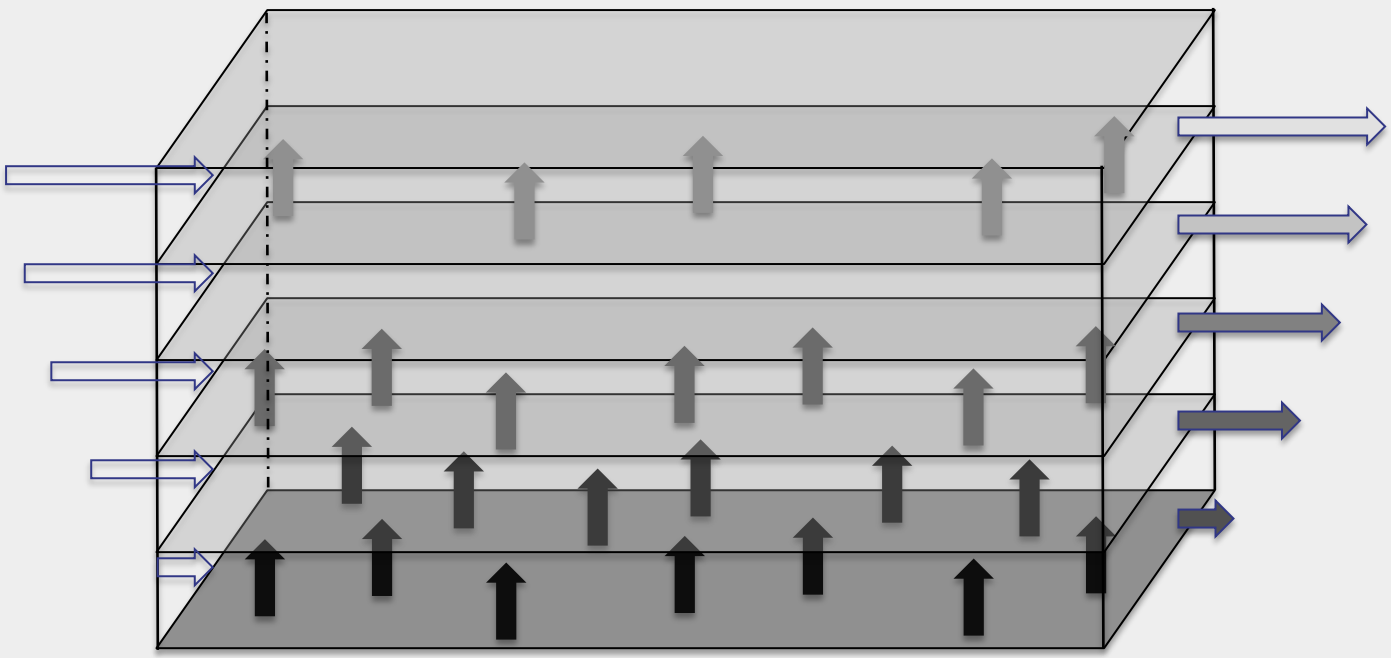
Box Model – The General Idea



Integrated Horizontal Flux

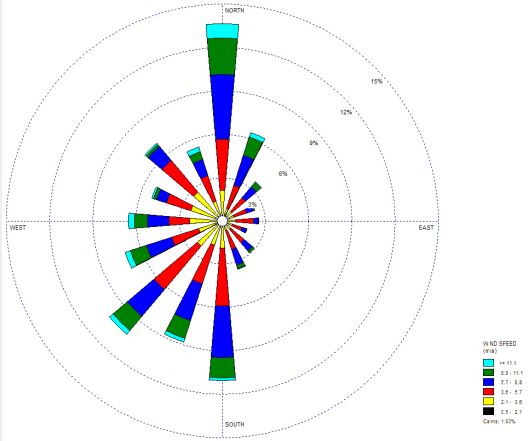
(a special case of the box model)



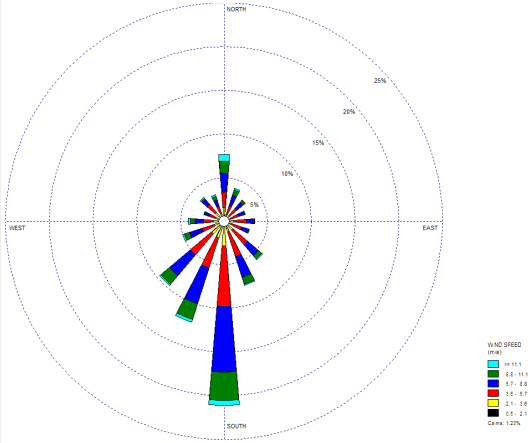
Both wind speed and mass concentration vary with elevation

Feedyard A
17-20,000 head

Amarillo Dec – Feb

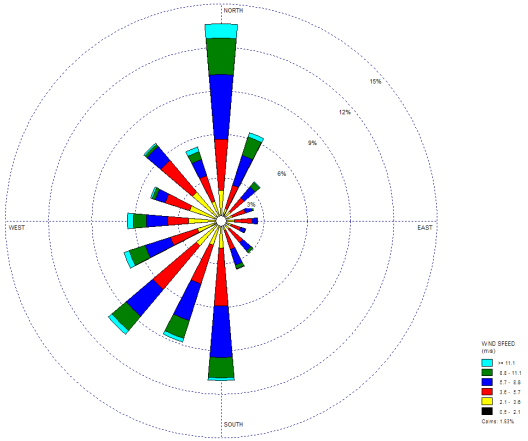


Amarillo Mar – Nov



Feedyard E
17-24,000 head

Amarillo Dec – Feb



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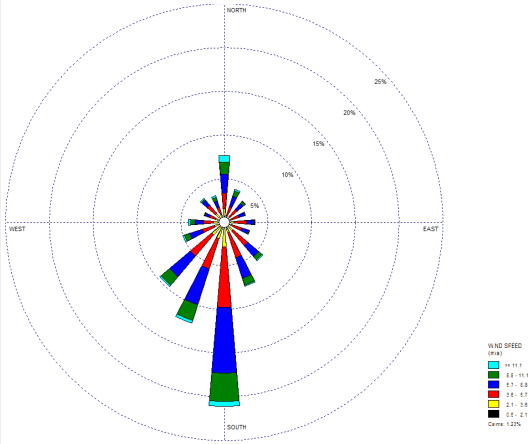
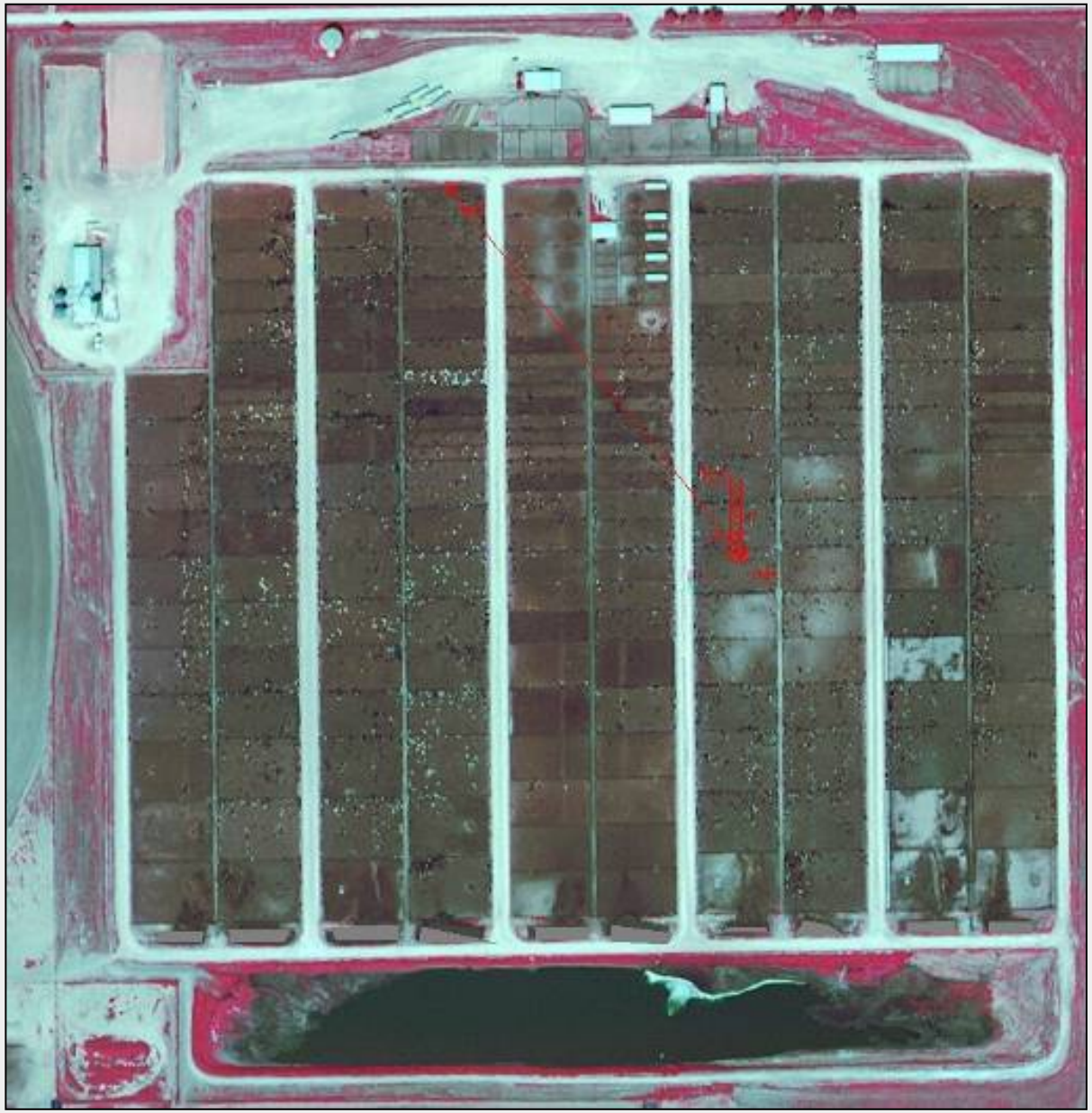
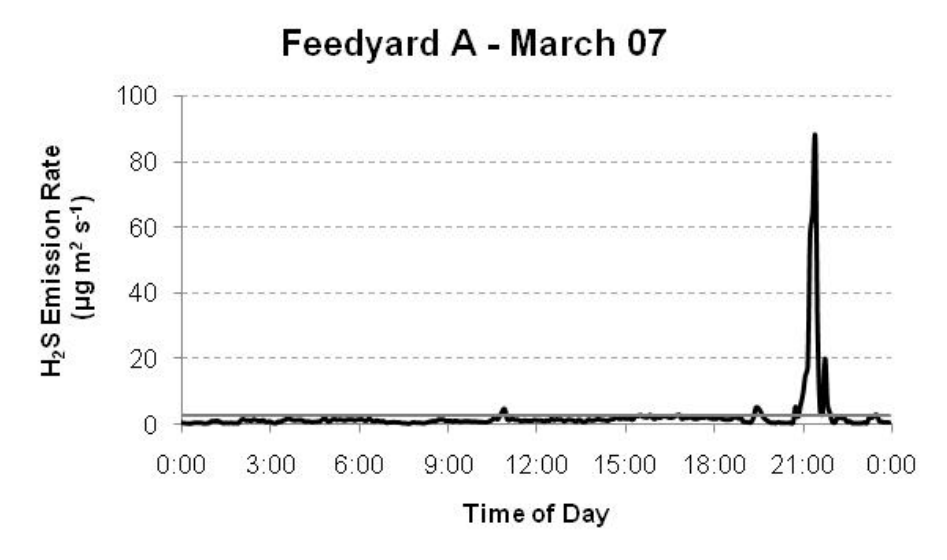
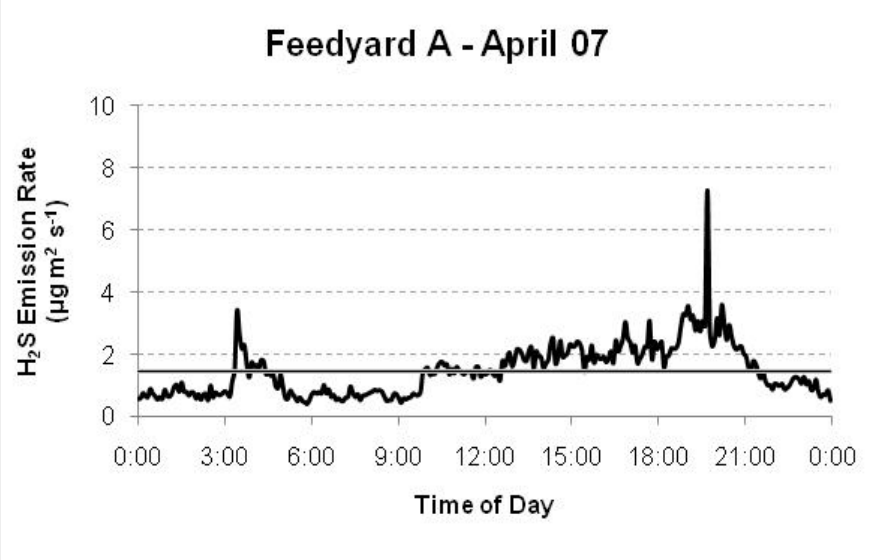


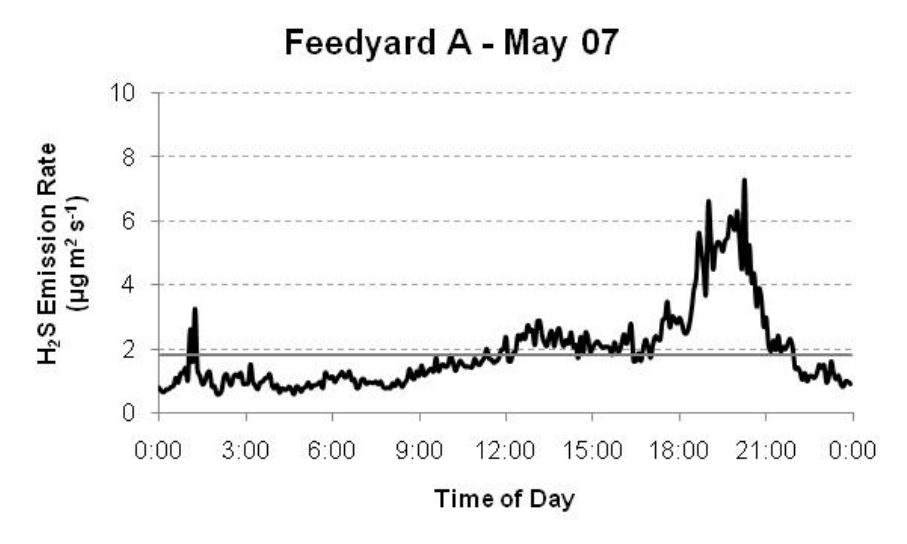


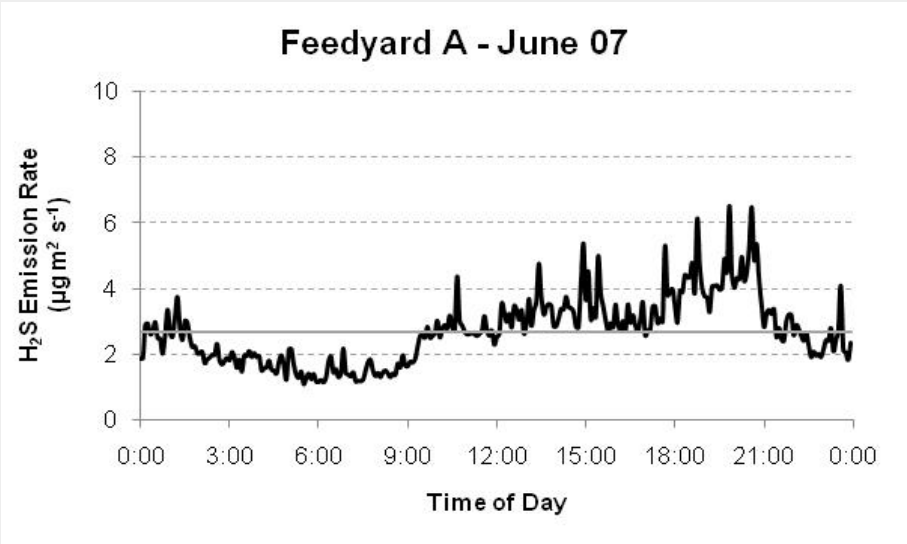
Feedyard A - H_2S Emission Rate from Pens

Diurnal Emissions Pattern

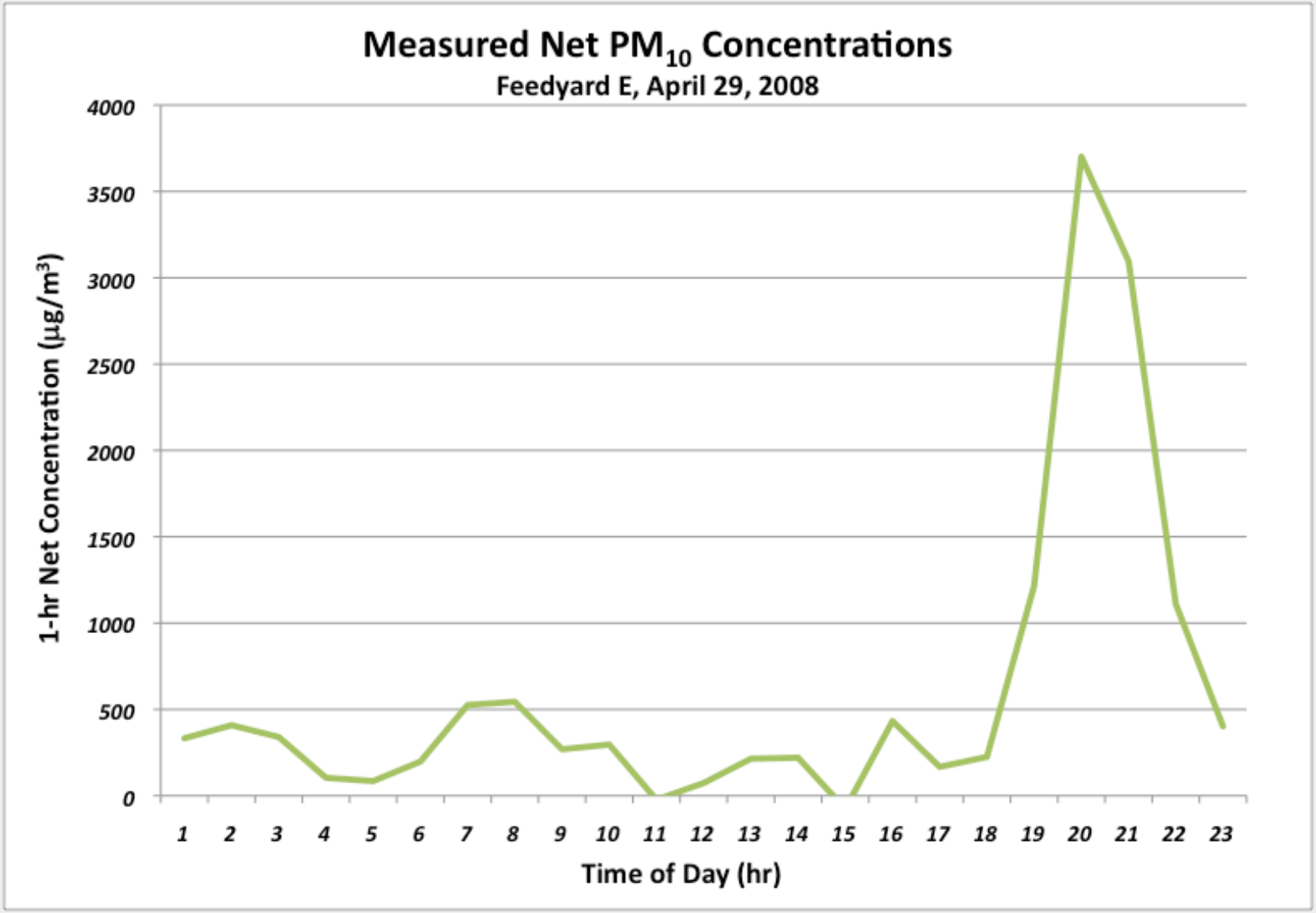








Is the Emission Flux Constant?



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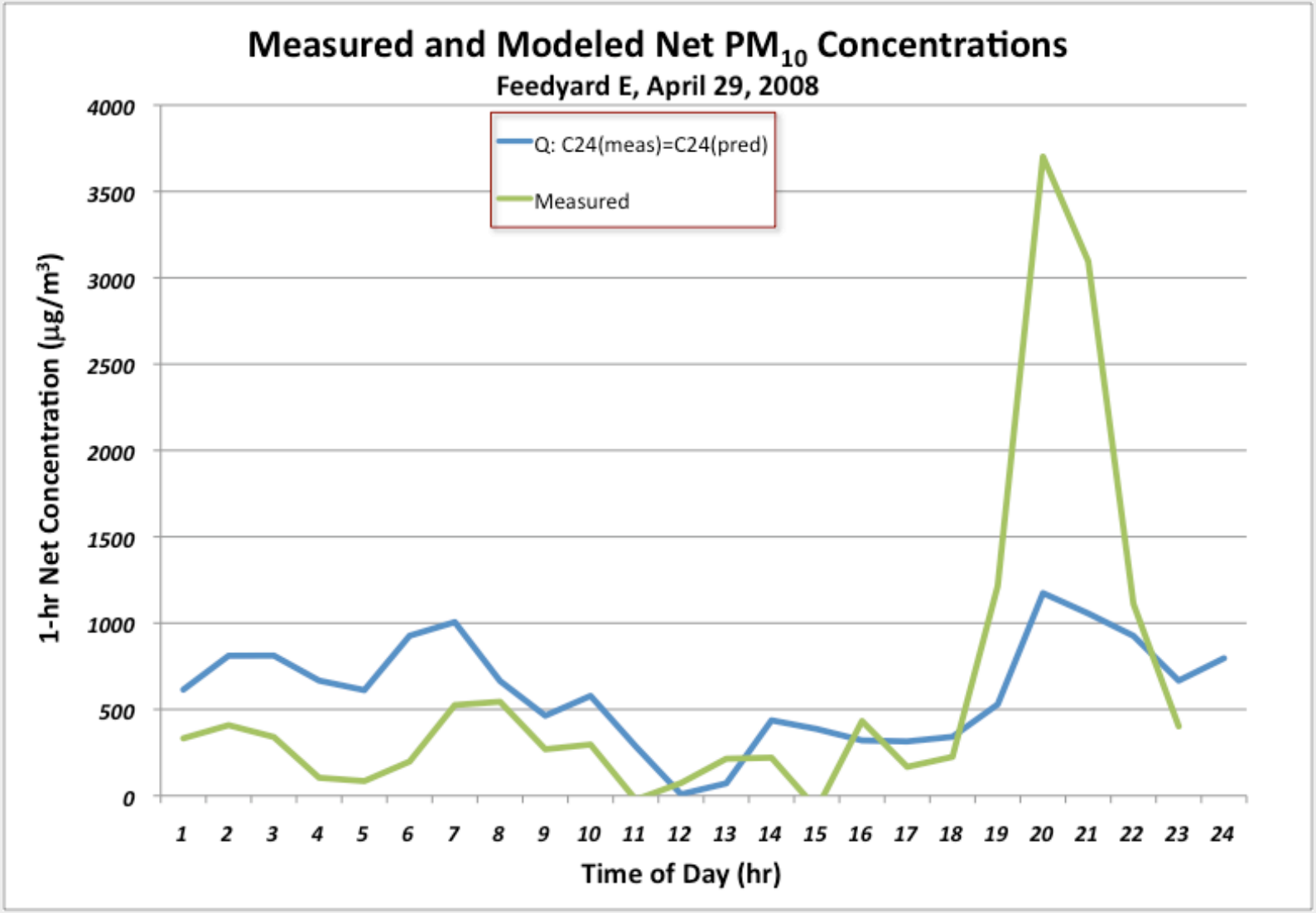

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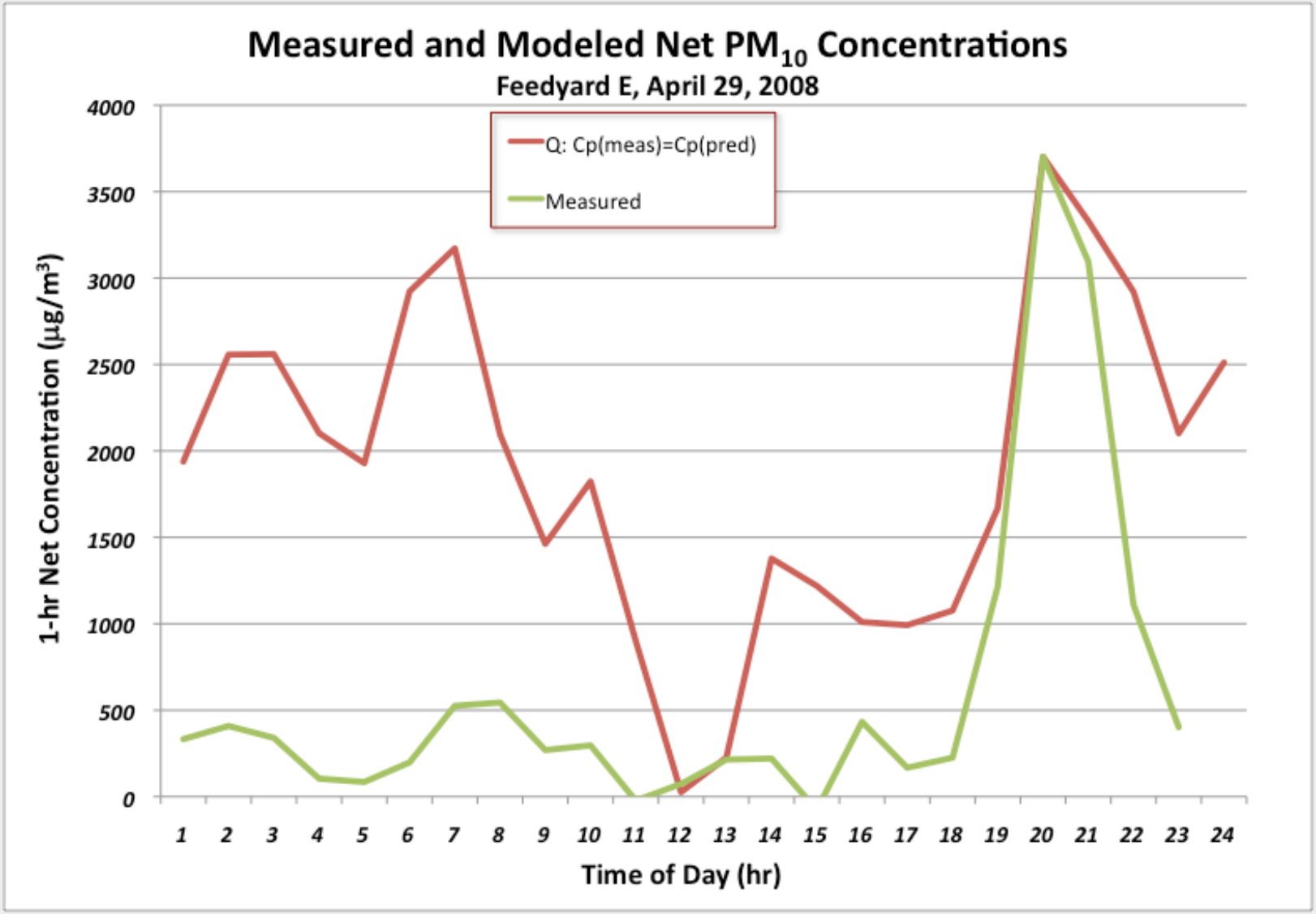

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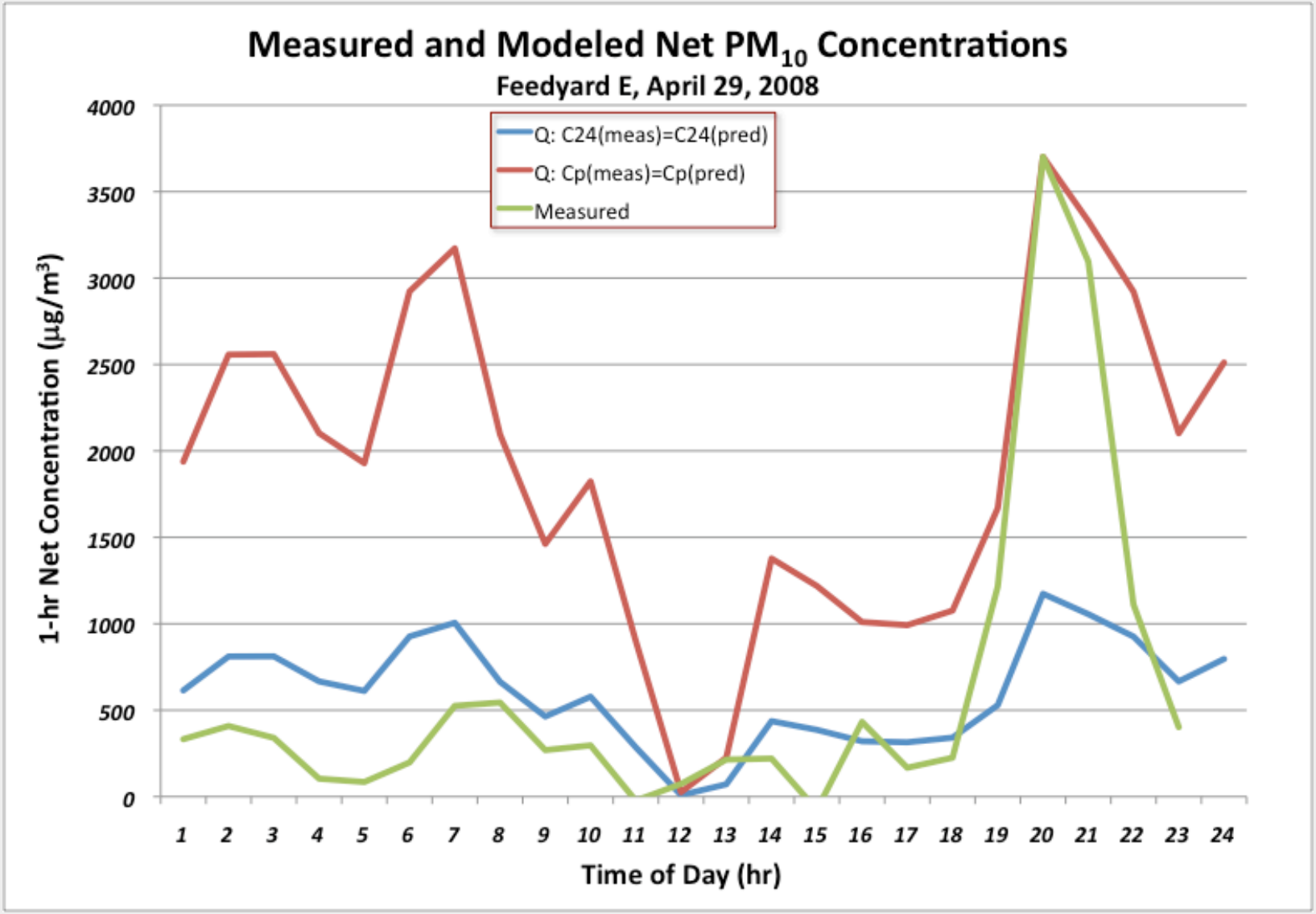


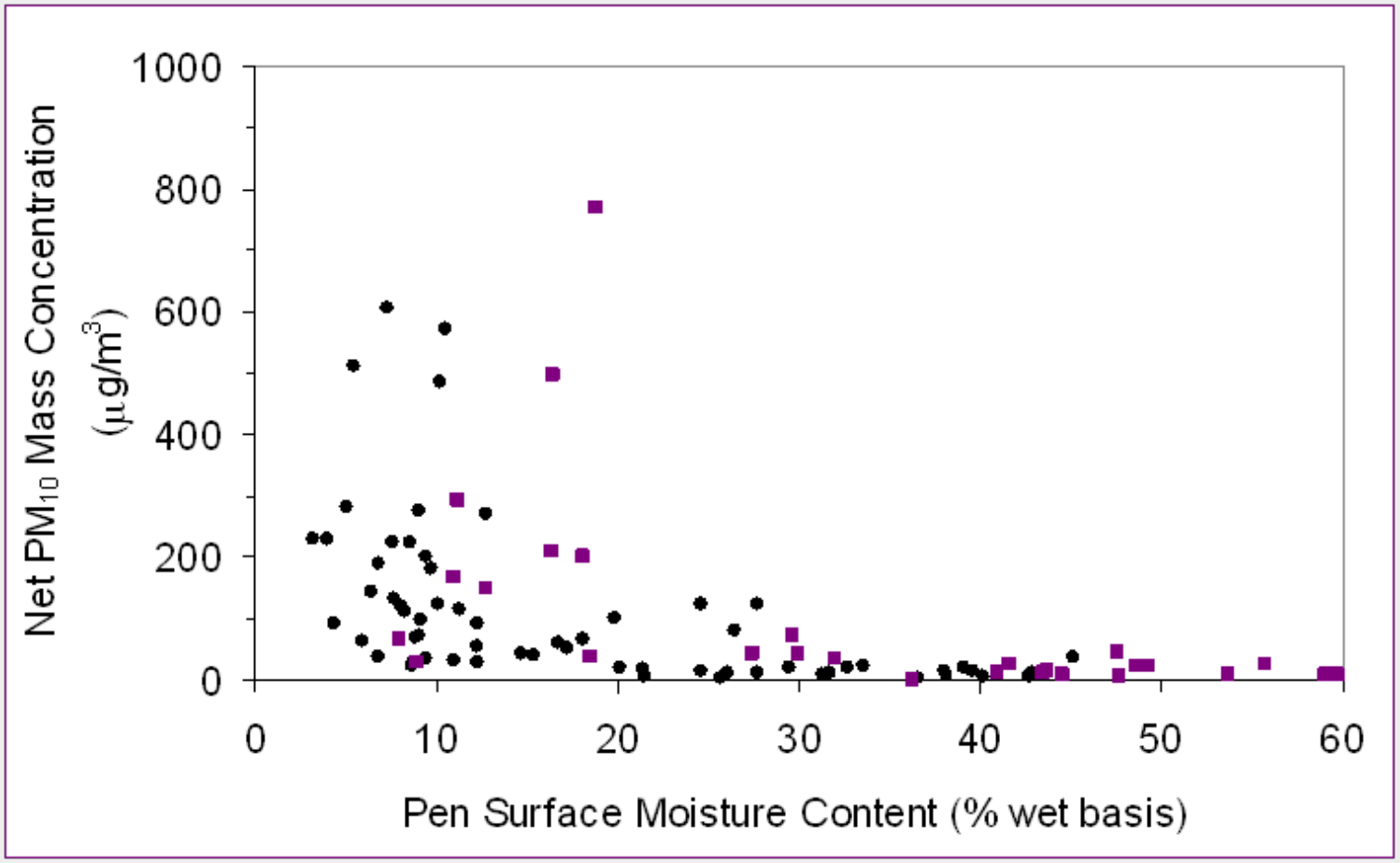
Modeling Flux: Achilles' Heel

- Under normal circumstances, no single value of PM_{10} emission flux will reproduce measured concentrations exactly
  - Matching the 24-hr average, $C_{meas,24}$, underpredicts C_{peak}
  - Matching C_{peak} overpredicts $C_{meas,24}$
- Even if we must have a 24-hr emission factor, we shouldn't use it for dispersion modeling

Fugitive Dust Control Strategies

- Source control techniques
  - Moisture management
    - Pen surface sprinkling
    - Stocking density manipulation
  - Manure harvesting
  - Surface amendments (mulches, binders, etc.)
- Edge-of-feedyard or downwind control techniques
  - Water curtain
  - Shelterbelts

Moisture Management Target Moisture Content?

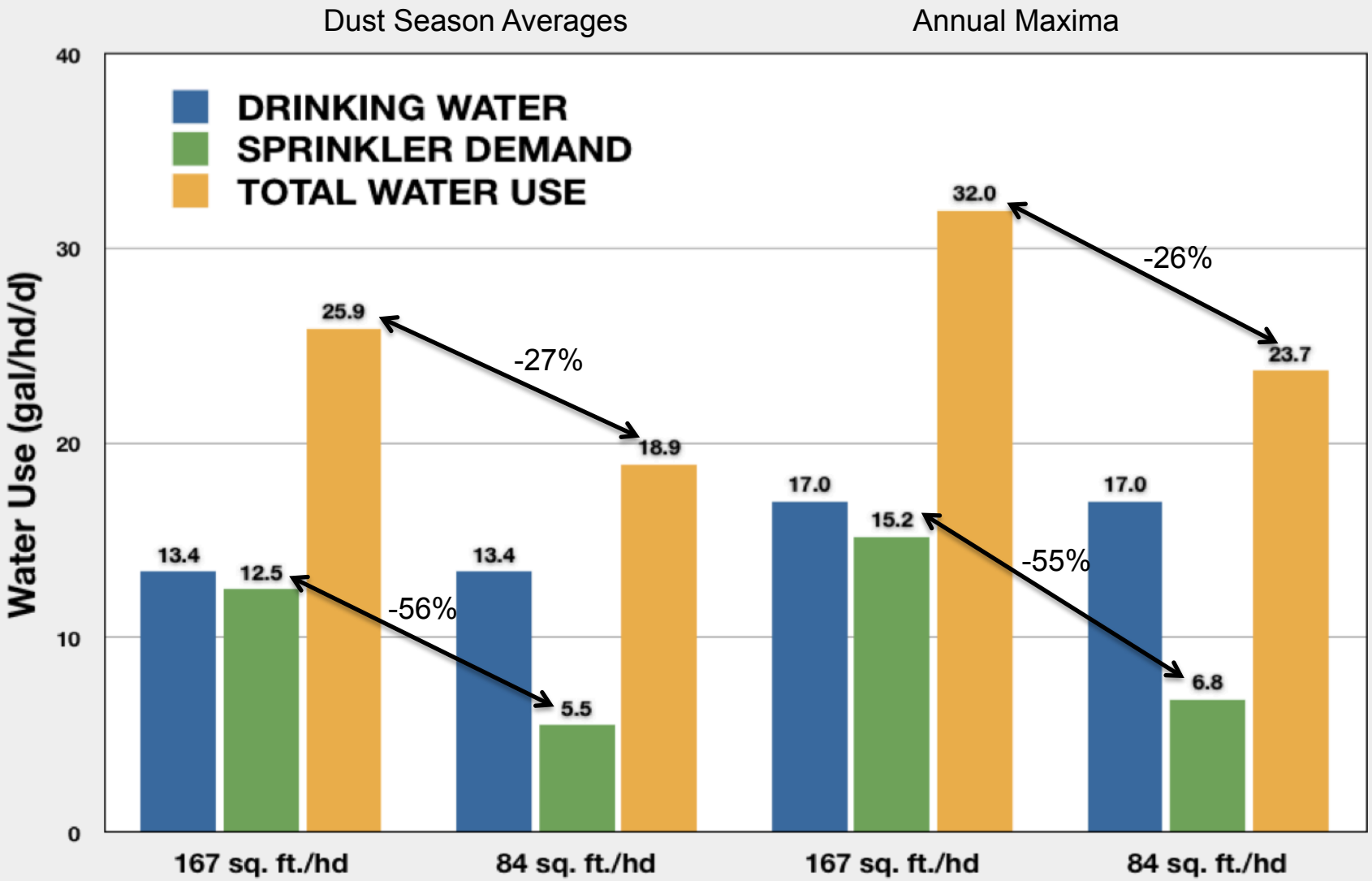


Net PM_{10} Concentrations vs. Pen Surface Moisture Content.

Pen Surface Sprinkling

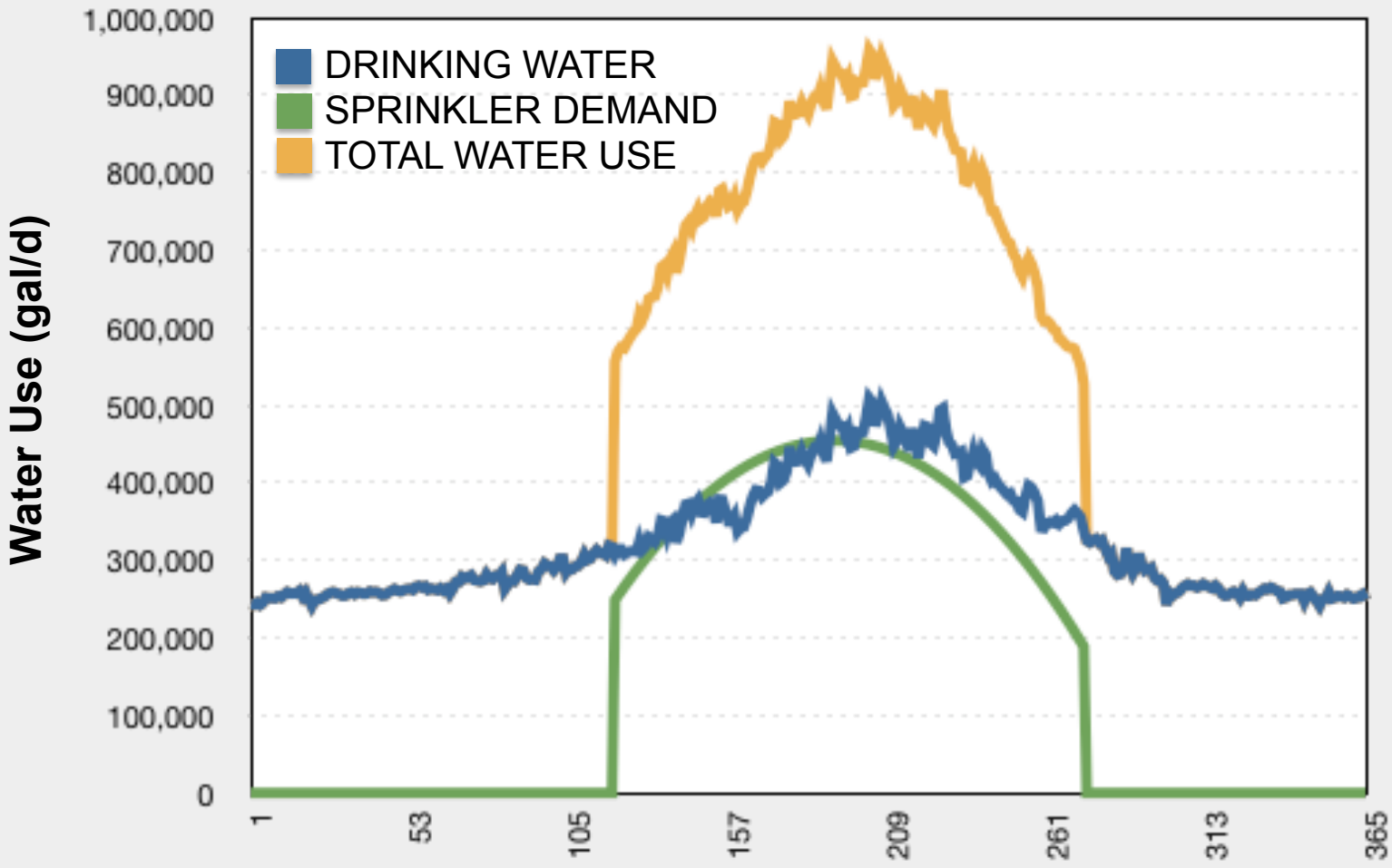
- Application of water to pen surfaces (solid-set, tanker-mount, “reel rain”)
- **Efficacy**
  - Reduced net PM_{10} concentration by 30 to 55%
- **Readiness for adoption**
  - Ready for producer implementation
  - Need to refine design and management procedures

Stocking Density Effect on Water Balance



Projected Water Use (30k hd)

(Pacific Northwest rain shadow)



Sprinkler Water Demand: Summary

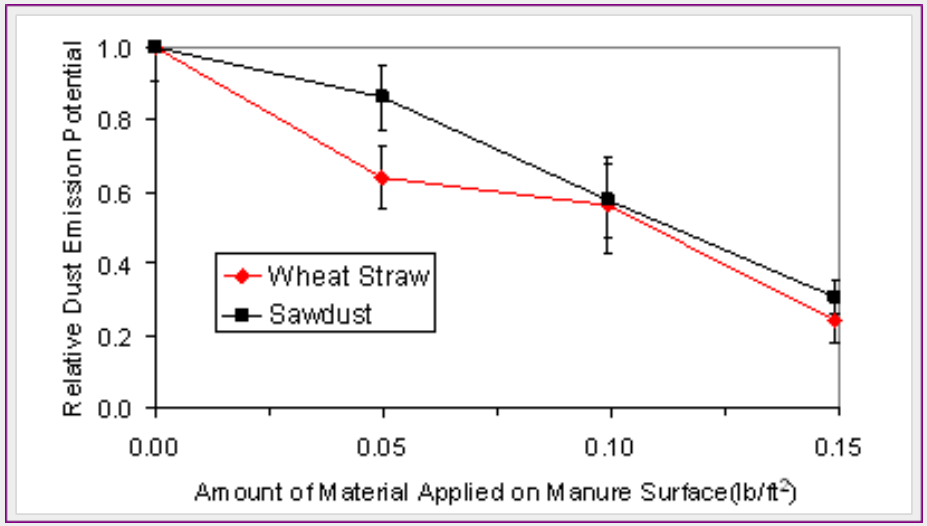
- Spreadsheet exercise ONLY
- Assumed ET_{fy}=0.35 ET_o
  - Marek thesis: ET_{fy}, Et_o not well correlated
  - Feedyard evaporation is water-limited, not energy-limited
  - Bottom-line sprinkler demand figure of 1/8”/d is artificially low
- 2x stocking density effect on WB appears minimal

Manure Harvesting

- Frequent removal of the uncompacted surface layer
- **Efficacy**
  - Dust emission potential of manure layer decreases with decreasing manure depth
  - Manure harvesting can reduce the amount of water needed for dust control
  - Yields highest fuel value
- **Readiness for adoption**
  - Ready for producer implementation
  - Need to refine management procedures
  - Law of diminishing returns

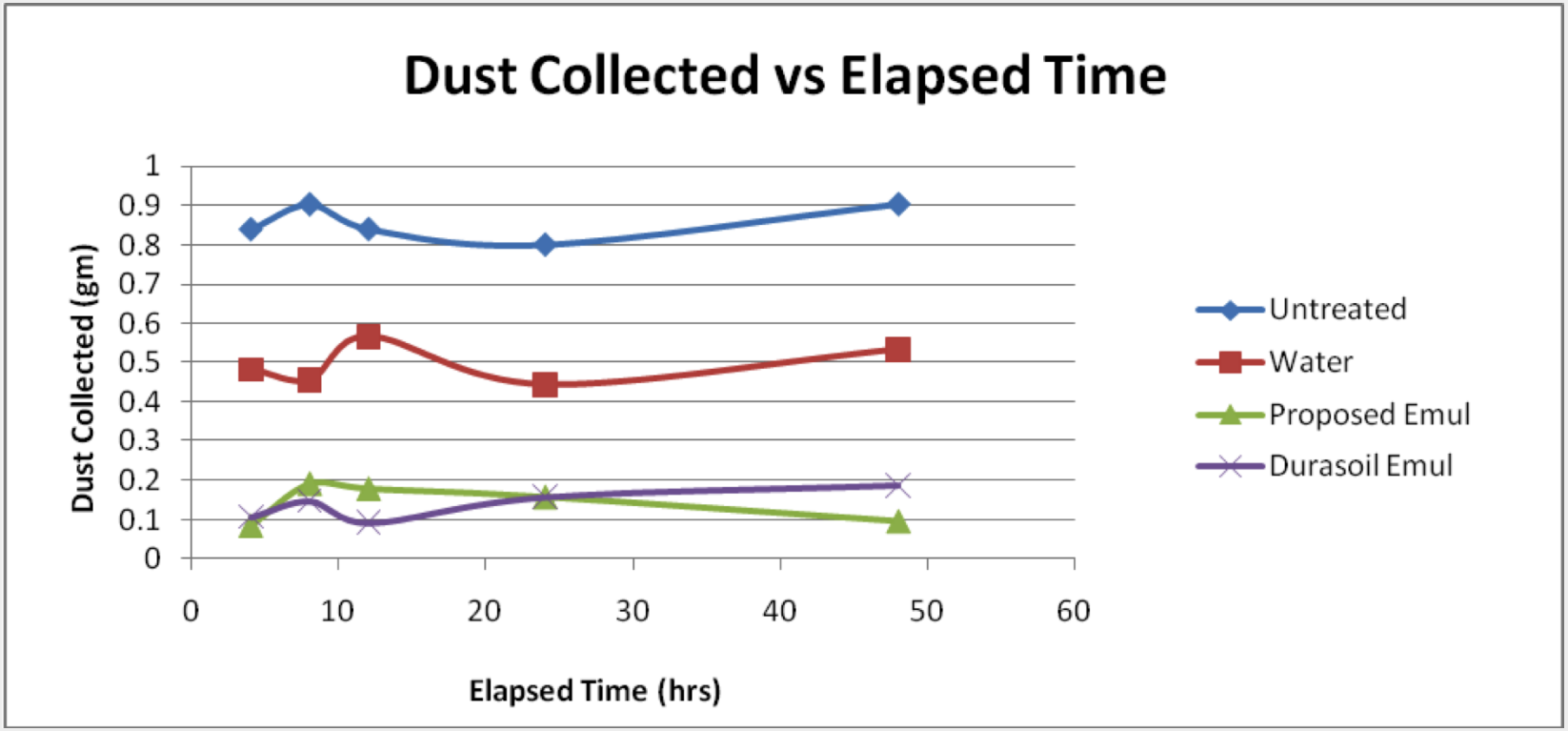
Surface Amendments

- Surface application of crop residue or other materials
- **Efficacy**
  - Application of wheat straw or sawdust reduced the dust emission potential of a manure surface
- **Readiness for adoption**
  - Promising but needs to be validated at the field level



Oil-in-Water Emulsions

- Water is the “continuous phase”
- “Oil” at $2.05/gal, 20% v/v, 0.25” applied



Stocking Density Manipulation

- Cross-fencing (solid or electric)
- Preserve 100% of bunk space
- **Efficacy**
  - Doubling the effective stocking density reduced net PM_{10} **<u>concentrations</u>** at the corral fence line by 20%
  - No conclusive proof of reduced emission **<u>rate</u>**
  - Anecdotal evidence from producers

Water Curtain

- Open-air wet scrubber
- **Efficacy**
  - Prototype reduced near-field PM_{10} concentration 20-40%
  - Used as much water as a solid-set sprinkler system (1 gpm/ft)
- **Readiness for adoption**
  - Is not cost-effective

Shelterbelts

- Vegetation system downwind of a facility
- **Efficacy**
  - Effective in mitigating odor and dust generated from swine facilities and roads
- **Readiness for adoption**
  - Promising but needs field evaluation

Summary

- A surface moisture content of 20% may be a critical threshold for dust control.
- Strategies ready for producer implementation but need refinement
  - Pen surface sprinkling
  - Frequent manure removal
- Promising strategies that need further development or evaluation
  - Pen surface treatments
  - Shelterbelts
  - Increased stocking density with pen surface sprinkling