Monitoring Air Quality: Emissions and Odor From A Swine Finishing Livestock Facility

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5 Swine Finishing Barns, 3 Locations
Total Confinement – Liquid Manure
50 lbs to 260 lbs in 16 weeks
Fan Ventilated Barn and Manure Pit

Dunn County,

Elk Mound,

WI

Swine Barn Emission Measurements:

Determine emission rates: hydrogen sulfide, ammonia, and odor from each hog barn.

Measure exhausted hydrogen sulfide concentration with a JEROME 631-X Gas Analyzer.

Measure exhausted ammonia concentration with gas detection tubes.

Determine odor emission rate by collecting a bag sample of exhaust air for lab analysis by dynamic olfactometry.

Determine on-site odor using Nasal Ranger® Field Olfactometer.

Agricultural Ammonia Emissions

- **From livestock housing facilities**
- **Manure storage areas**
- **Manure and fertilizer application areas**
  - **Ammonia nitrogen volatilizes (gas), emitted to atmosphere, deposited back to land and water.**
    - Ecosystem N fertilization: Plant species shift from native to grassy; Acidification; N into Mississippi / Gulf: Hypoxia
    - Atmospheric particulates cause haze: Human respiratory health issues

Ammonia Monitoring Equipment

- Stationary tube on fan

  or

- Gas detection pump

  - Both utilize gas detection tubes.
  - Ammonia sensitive substance changes color.
  - Height of color change = concentration over time.

Ammonia Monitoring : Barn & Pit Fans

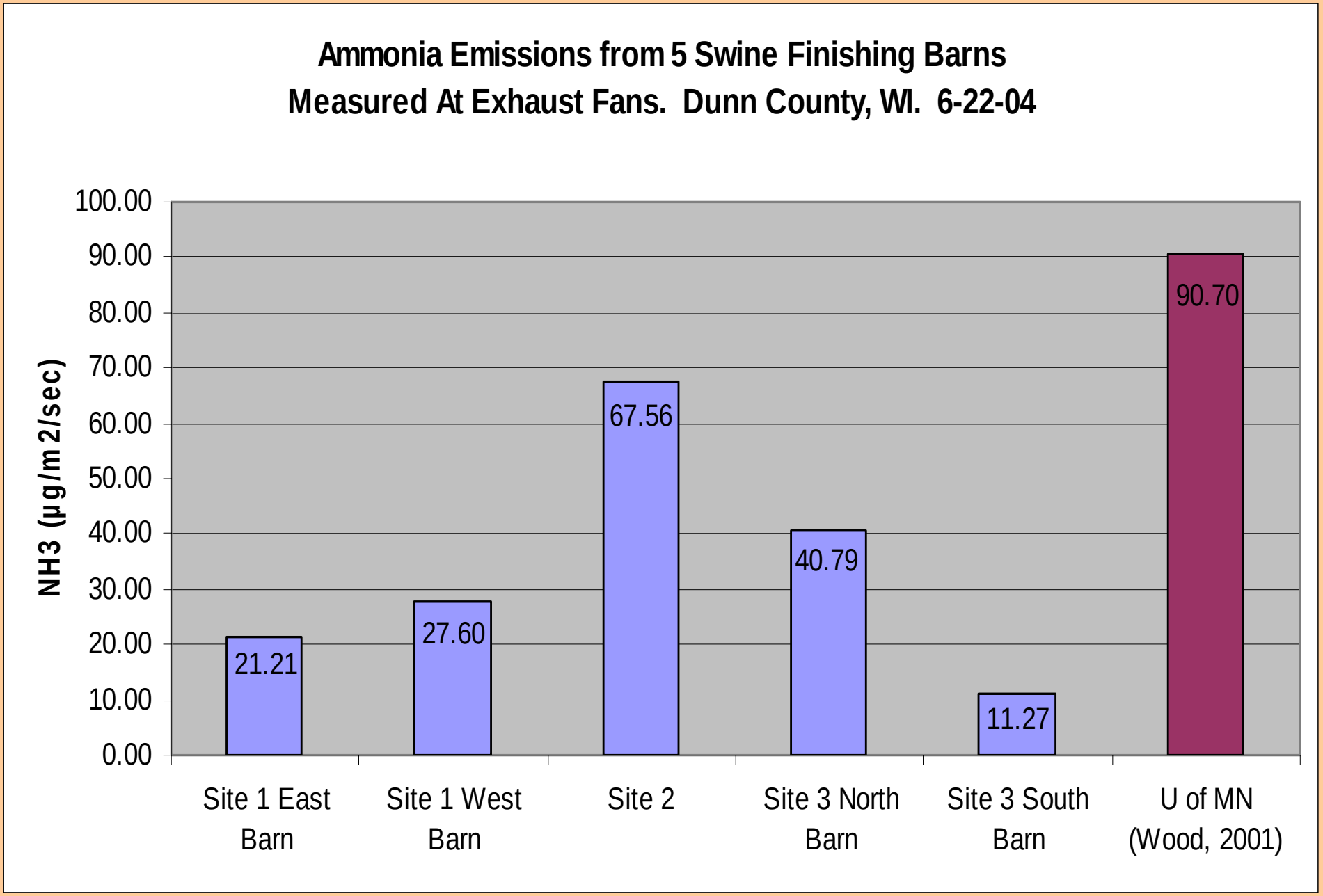
Indicator tube attached to pump draws known air volume across tube over time.

Ammonia Monitoring : Barn & Pit Fans

Blue color = ammonia detection.
Height = concentration.

Stationary diffusion tube attached to fan for a recorded time period.

Ammonia Results



Agricultural Hydrogen Sulfide Emissions

- H_2S is product of anaerobic decomposition of organic matter.
- Liquid livestock manure storage generates H_2S.
- H_2S is toxic: Human / animal health concerns
  - Dizzy, headache, nausea @ 50 ppm.
  - Death from respiratory paralysis @ 1,000 ppm.
  - OSHA indoor workplace standard is 10 ppm for 8 hour day.

Jerome 631-X Hydrogen Sulfide Analyzer

H_2S measured with a Jerome Meter, twice every 2 minutes for ½ hour.

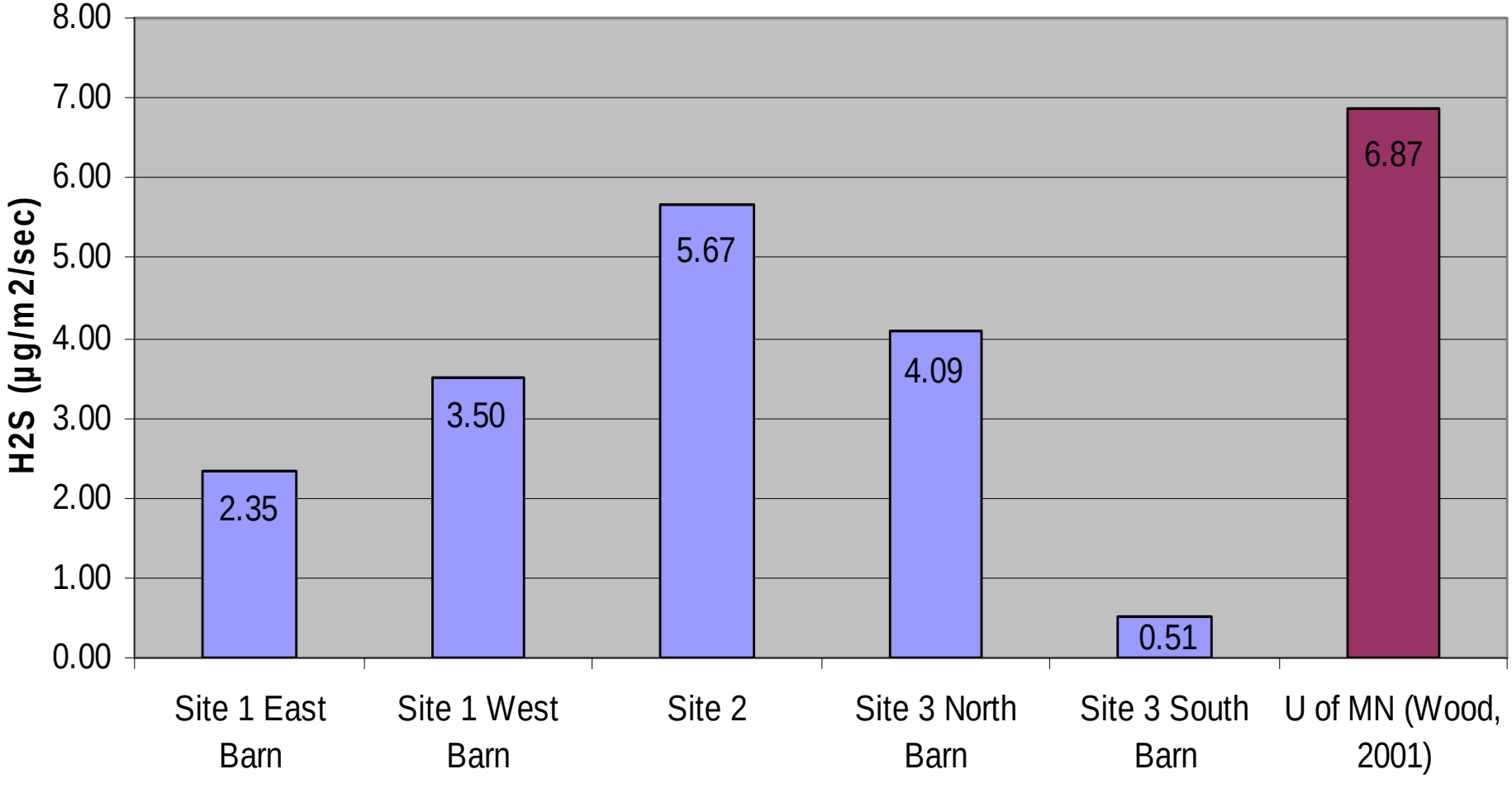
Weather data gathered: wind speed, wind direction, air temperature, relative humidity and barometric pressure.

Measuring Hydrogen Sulfide

At Barn Exhaust Fans and Manure Pit Exhaust Fans

Hydrogen Sulfide & Odor Evaluation At Property Line

Hydrogen Sulfide Results



Livestock Facility Odor Emissions

- A mix of different gases, existing at low concentrations.
- Generated from any combination of manure, dust, decaying feed, etc.
- Odors evoke a wide range of physical and emotional reactions, both positive and negative.
- Many livestock facility odors are identified by surrounding neighbors as negative.
- Continued exposure to strong odor can cause olfactory fatigue. When people experiences odor fatigue their sense of smell is less sensitive.

Odor: Nasal Ranger Field Olfactometer

25 feet

50 feet

Property line

Carbon filtered air : Sample air.

Ratio changes as operator moves dial.

Operator trained to detect ratio where sample air is offensive.

See: www.nasalranger.com

Odor: Air Sampling For Lab Analysis: Dynamic Olfactometry

Tedlar bag filled from barn exhaust fans using vacuum chamber box and plastic tubing.

Delivered to lab within 24 hours for dynamic olfactory analysis.

Odor: Air Sampling For Lab Analysis: Dynamic Olfactometry

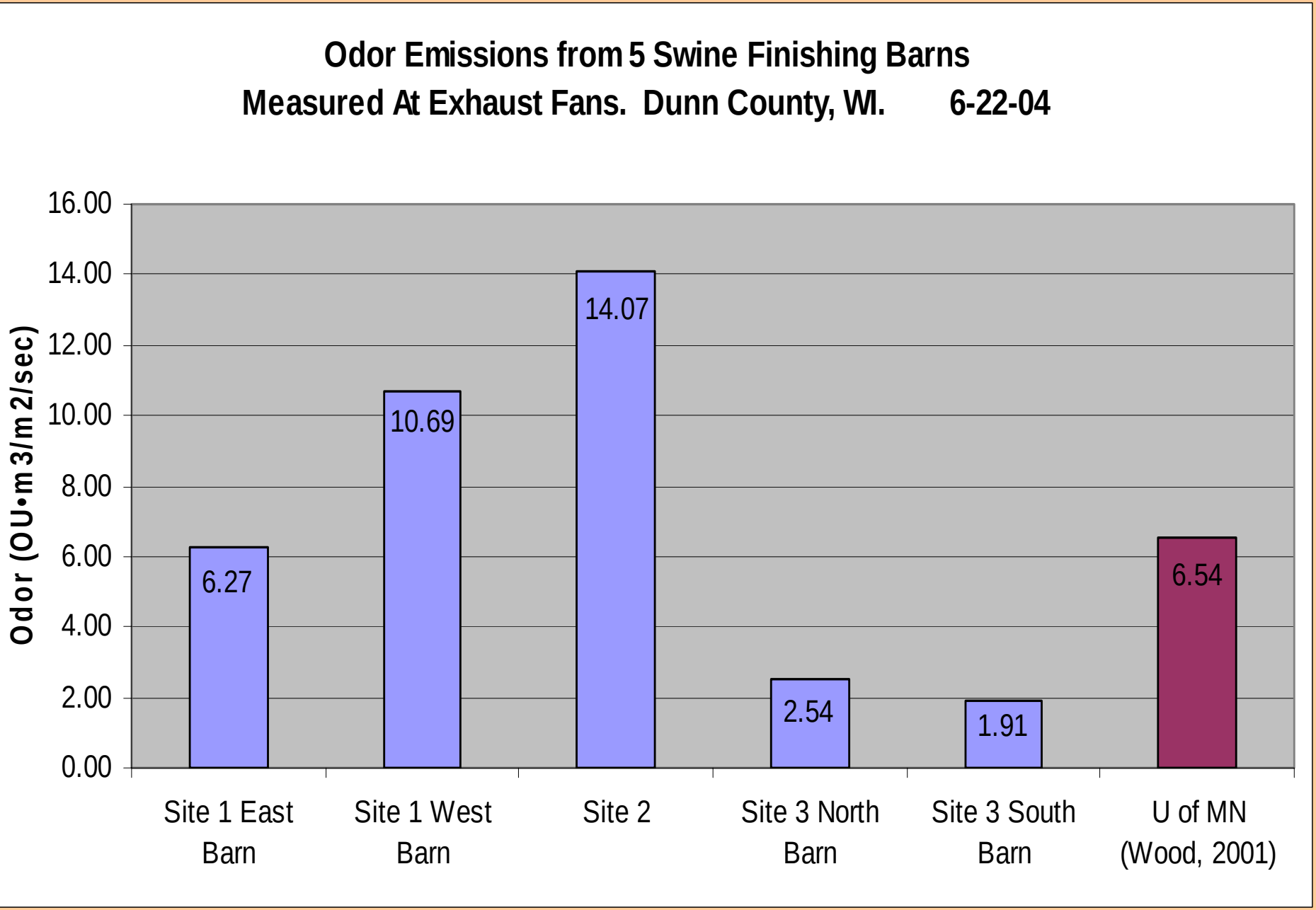
Dynamic olfactory analysis uses olfactometer + trained people.

Olfactometer is dilution device that mixes odorous air in specific ratios with odor free air for presentation to human panelist.

Panelists sample (sniff) air and identify ratio when odor is detected.

St. Croix Sensory, Inc., Lake Elmo, MN. www.fivesenses.com

Odor Results



Hourly Emission Concentrations At Property Line and Nearest Neighbor For 3 Swine Finishing Feedlots

Feedlot	Hydrogen Sulfide (µ/m3/hr)		Ammonia (µ/m3 /hr)		Odor Intensity (OU, d/hr)	
	Avg	Max	Avg	Max	Avg	Max
1. PL	6.2	9.3	52	78	18	27
1. NN	0.9	1.3	7	11	3	4
2. PL	8.6	16.7	12	20	15	30
2. NN	2.2	6.4	3	11	4	11
3. PL	4.8	13.4	50	133	3	8
3. NN	1.2	6.8	14	76	1	6
Standard	**5.3**		**1070**		**25**	

PL = Property Line NN = Nearest Neighbor

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- *Working to assure a healthy farm economy and a healthy environment*

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