

CIG Air Monitoring Project October 2006 – June 2009



**Presented to the
Agricultural Waste Air Emissions
Advisory Group
April 7, 2010**

Background Air Issues



Air Toxics rule regulates hydrogen sulfide (H₂S) and ammonia (NH₃) at the property boundary

NR Board delayed implementation of Air Toxics rule for agricultural sources until July 2011

Approach for rule to be based on BMPs

CIG Air Monitoring Project Design

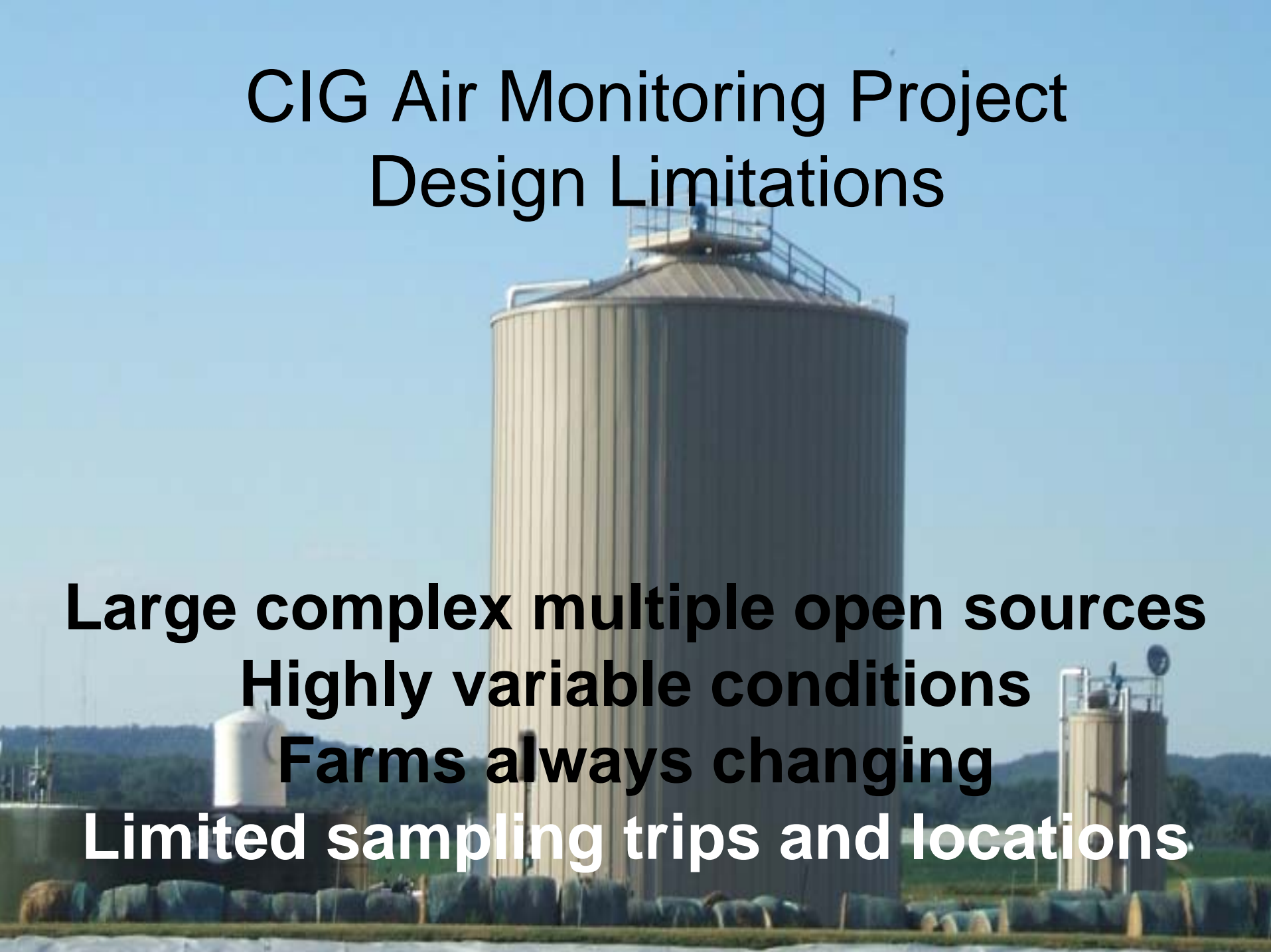


Study examined concentrations of H₂S and NH₃ on and near waste lagoons, before and after installing BMPs

Study did not examine property boundaries

CIG Air Monitoring Project Design Limitations

Large complex multiple open sources
Highly variable conditions
Farms always changing
Limited sampling trips and locations



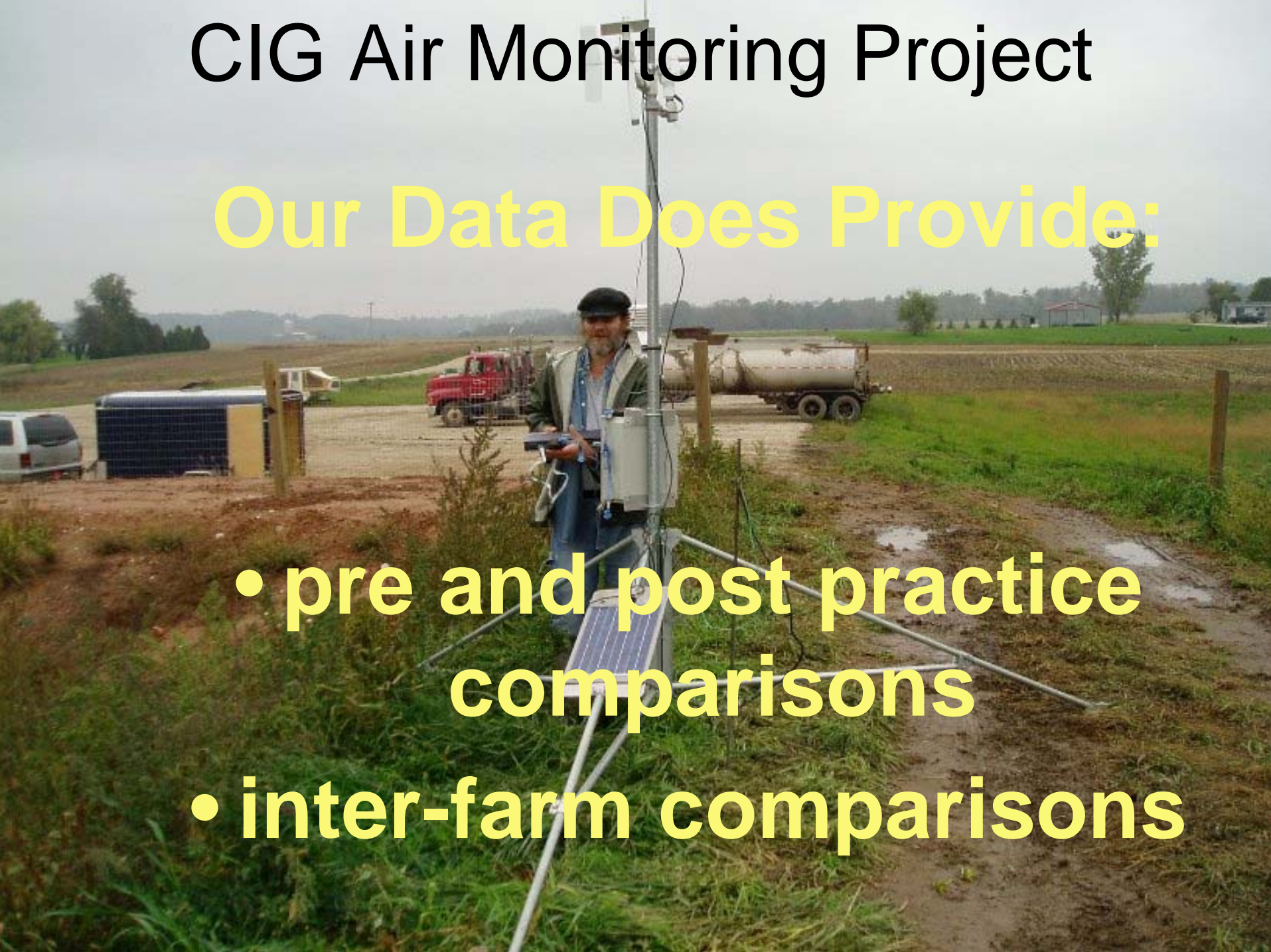
CIG Air Monitoring Project Results of Design Limitations

- **MAY NOT** be representative of typical conditions – small sample size
- **Can NOT** be **DIRECTLY** compared to NR445
- **Can NOT** be used to determine emission factors or overall emissions

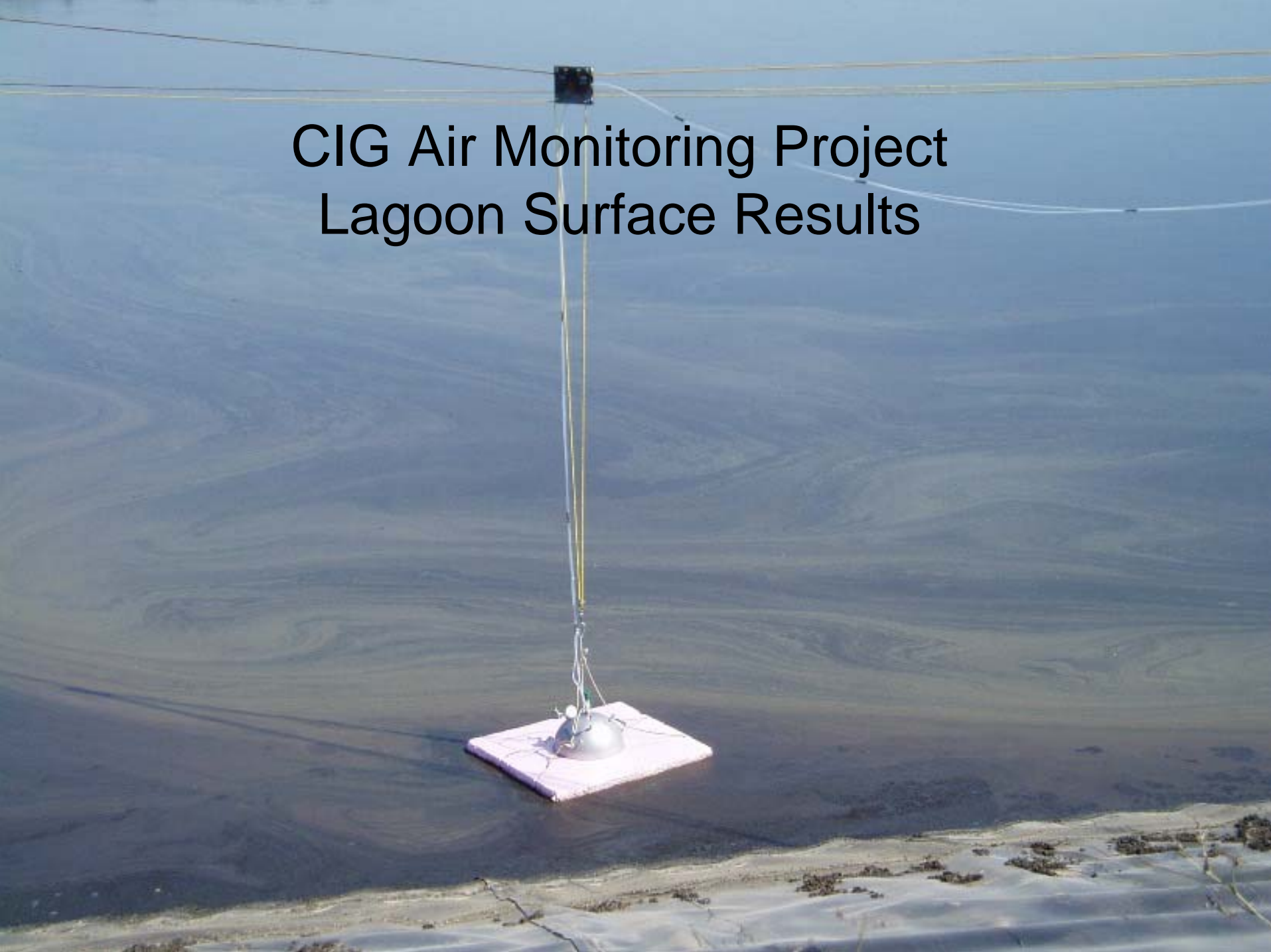
CIG Air Monitoring Project

Our Data Does Provide:

- pre and post practice comparisons
- inter-farm comparisons



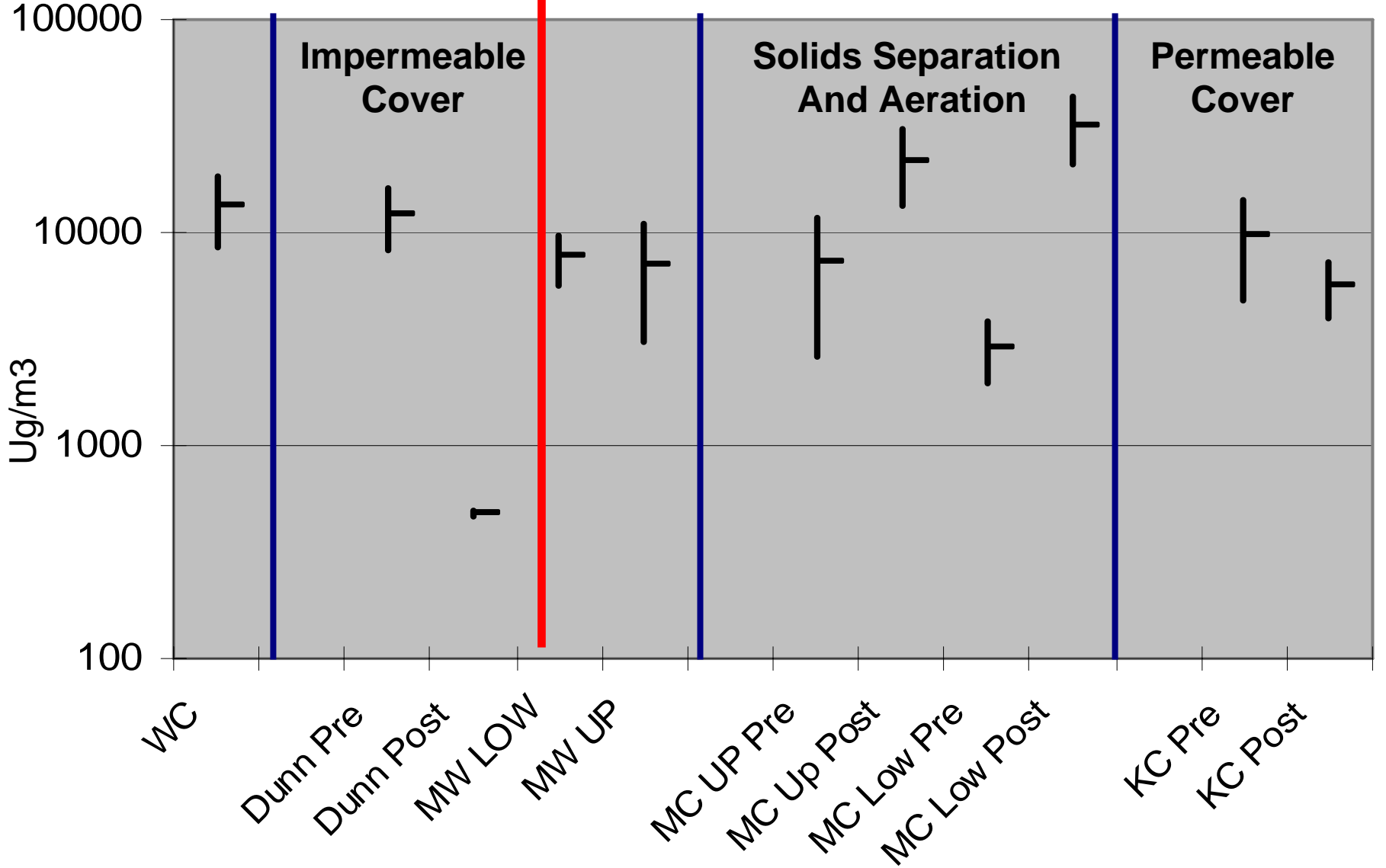
CIG Air Monitoring Project Lagoon Surface Results



Lagoon Surface NH3

DIGESTORS

UNDIGESTED MANURES



CIg Air Monitoring Project Lagoon Surface Results

NH₃ Concentrations:

Digested manure > undigested manure

Impermeable cover << no cover

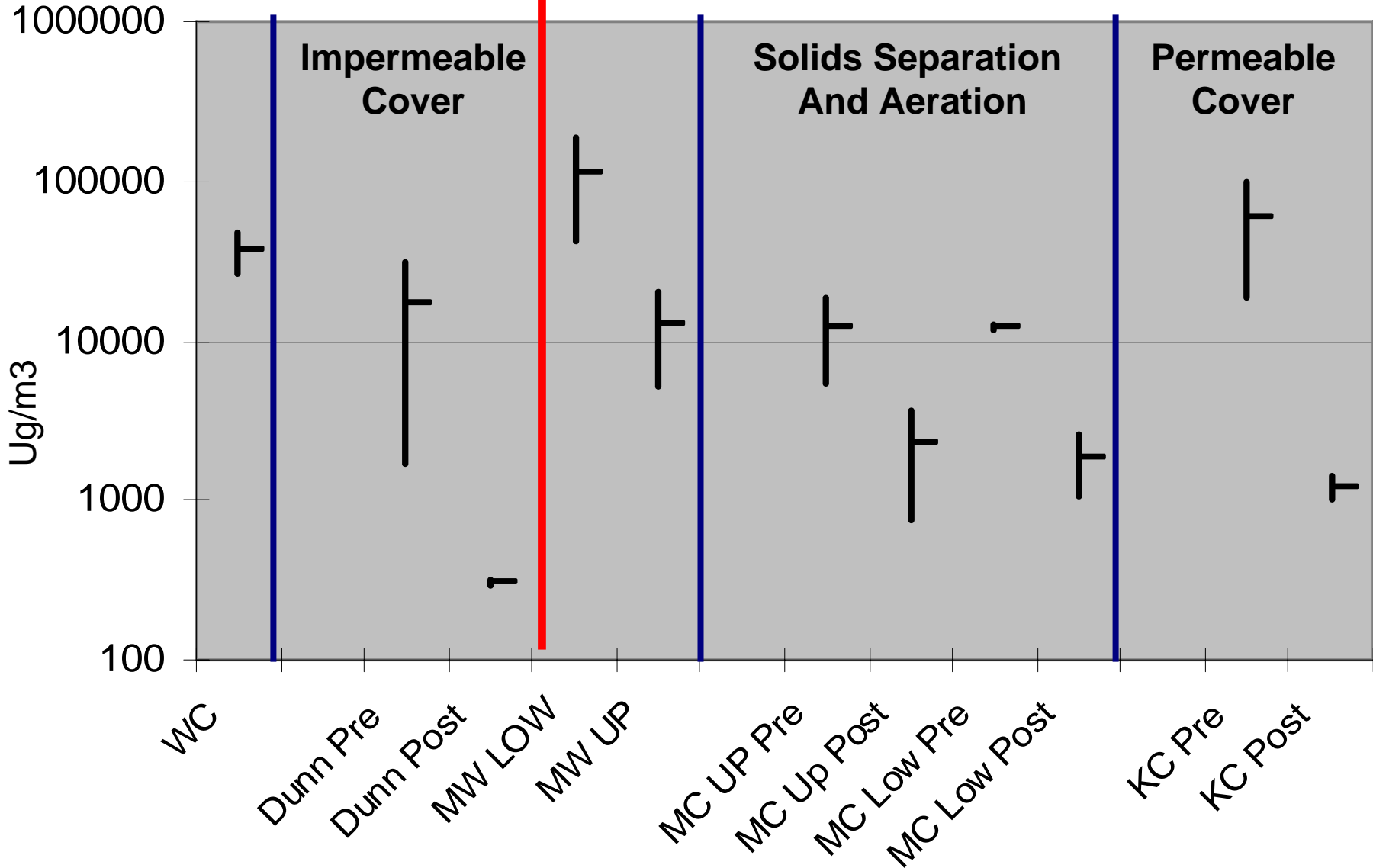
Permeable cover = no cover

Aeration > no aeration

Lagoon Surface H2S

DIGESTORS

UNDIGESTED MANURES



CI G Air Monitoring Project Lagoon Surface Results

H₂S Concentrations :

Digested manure = undigested manure

Impermeable cover << no cover

Permeable cover < no cover

Aeration < no aeration

CIG Air Monitoring Project

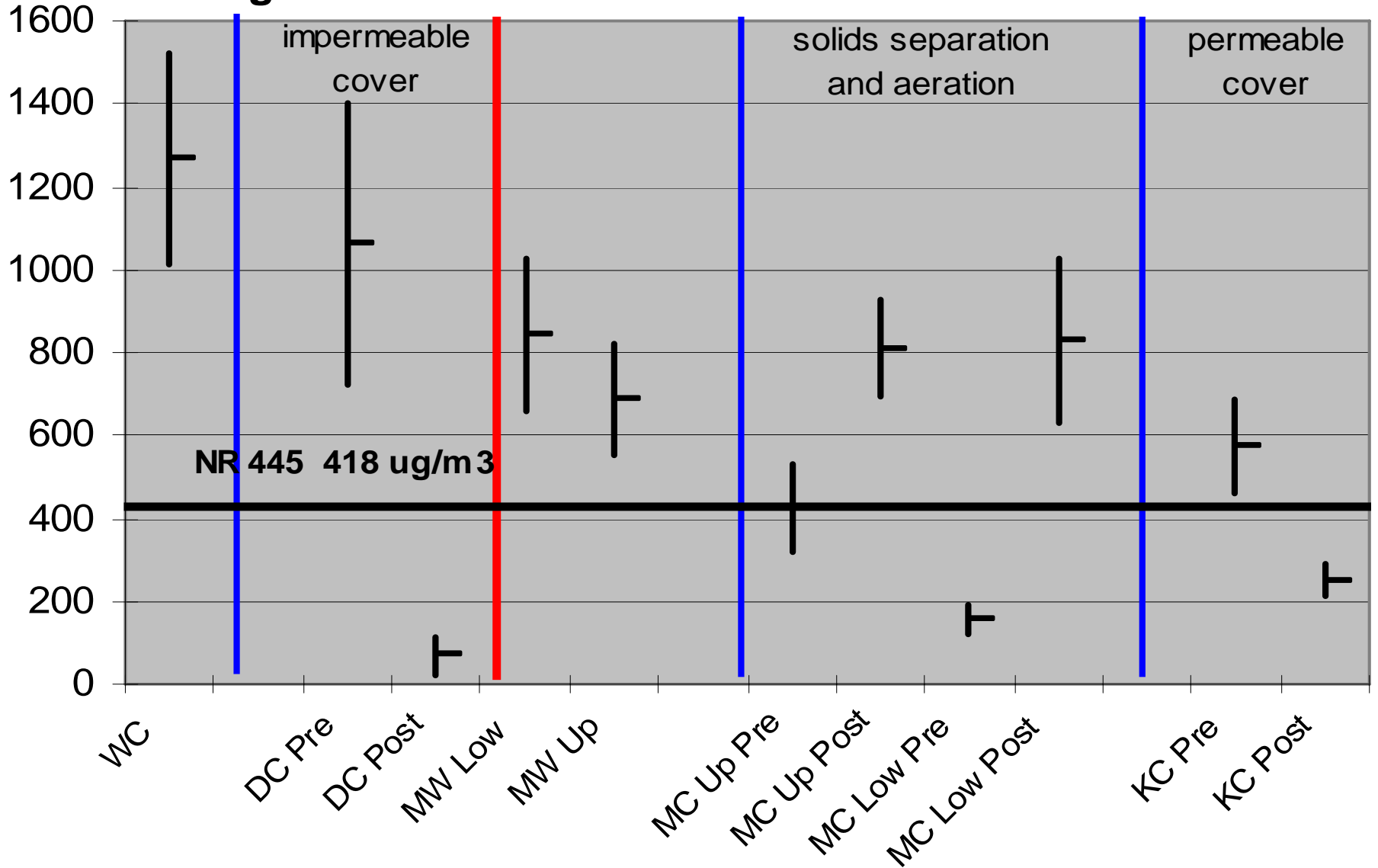
A person wearing a dark t-shirt and blue jeans stands in a grassy field. They are holding a clear plastic bag. To their right is a tall, silver metal pole. Several yellow ropes are attached to the pole and extend across the field. In the background, there is a dirt path, a green field, and some trees under a clear blue sky.

Ambient Sampling

Near Lagoon Ambient NH3

Digestors

Undigested Manures





CIG Air Monitoring Project

Near Lagoon Results

NH₃ Concentrations:

Digested manure > undigested manure

Impermeable cover << no cover

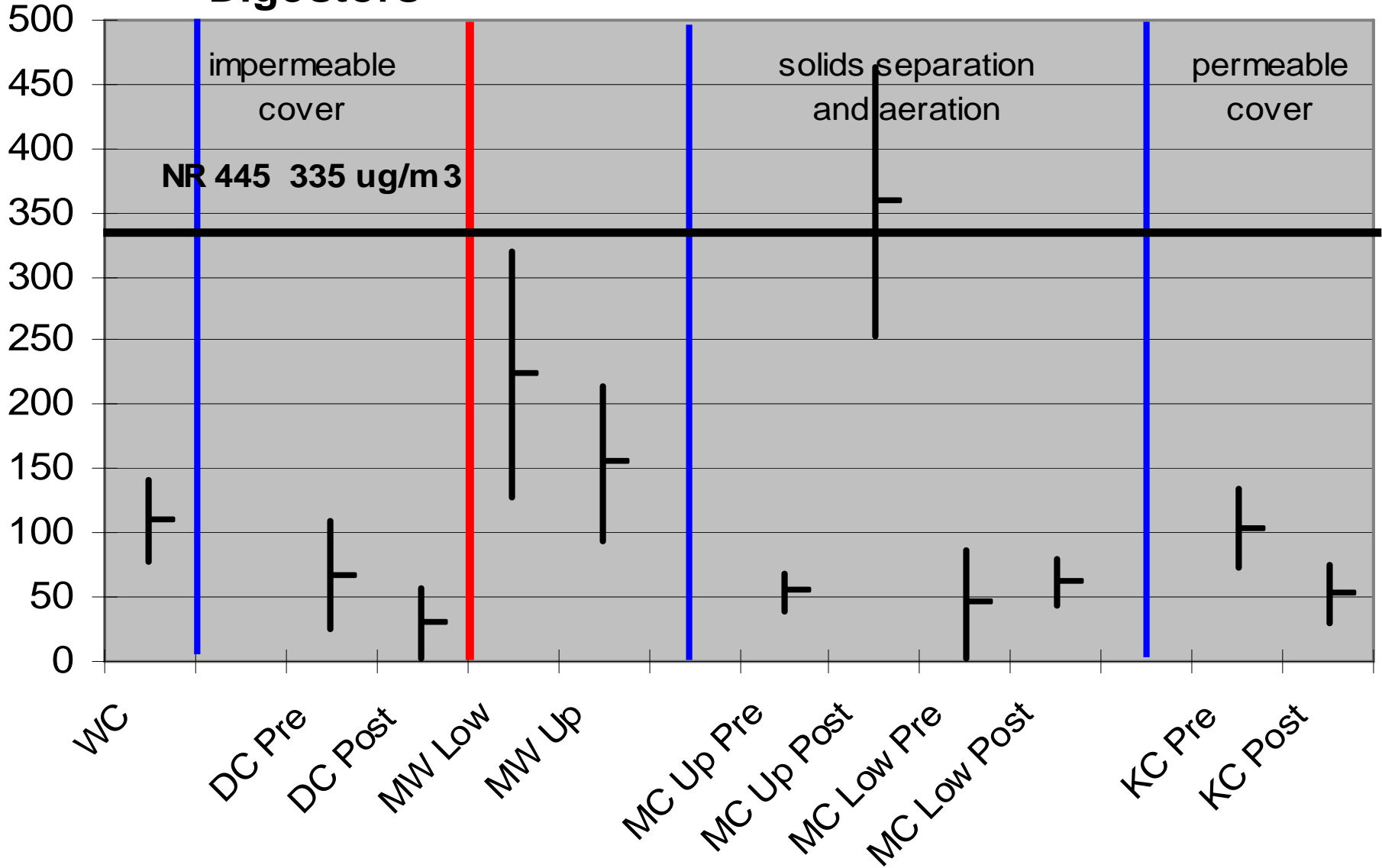
Permeable cover < no cover

Aeration > no aeration

Near Lagoon Ambient H2S

Digestors

Undigested Manures





CIG Air Monitoring Project

Near Lagoon Results

H₂S Concentrations:

Digested manure = undigested manure

Impermeable cover somewhat < no cover

Permeable cover somewhat < no cover

Aeration locally > no aeration

Ambient Air Concentrations
Daytime Levels

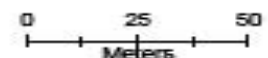
Waupaca County
September 4, 2007



Field Sampling Measurements
(Micrograms per Cubic Meter)

Location	NH3	H2S
1	2101	66
3	1594	43
5	489	25
6	ND	54
7	ND	35
9	ND	ND
11	ND	ND
13	ND	ND
15	ND	ND
16	586	18
18	1050	131
19	1860	262
20	2293	93
27	ND	ND

Note: ND = Non-Detect (detection limits vary with conditions)



CIG Air Monitoring Project Conclusions

- Impermeable cover WILL significantly reduce NH_3 and H_2S near and on lagoons
- Semi-permeable cover reduces lagoon surface H_2S concentrations but not NH_3
- Semi-permeable cover reduces near lagoon concentrations of both gases



CIG Air Monitoring Project Conclusions

- Anaerobic digestion has no apparent effect on H₂S, but raises both near lagoon and lagoon surface NH₃
- Aeration MAY reduce LAGOON SURFACE H₂S concentrations, however it appears to RAISE Lagoon Surface NH₃ and near-by H₂S and NH₃ concentrations
- Almost all Near Lagoon H₂S Concentrations are LESS than Air Toxics Rule for Property Lines





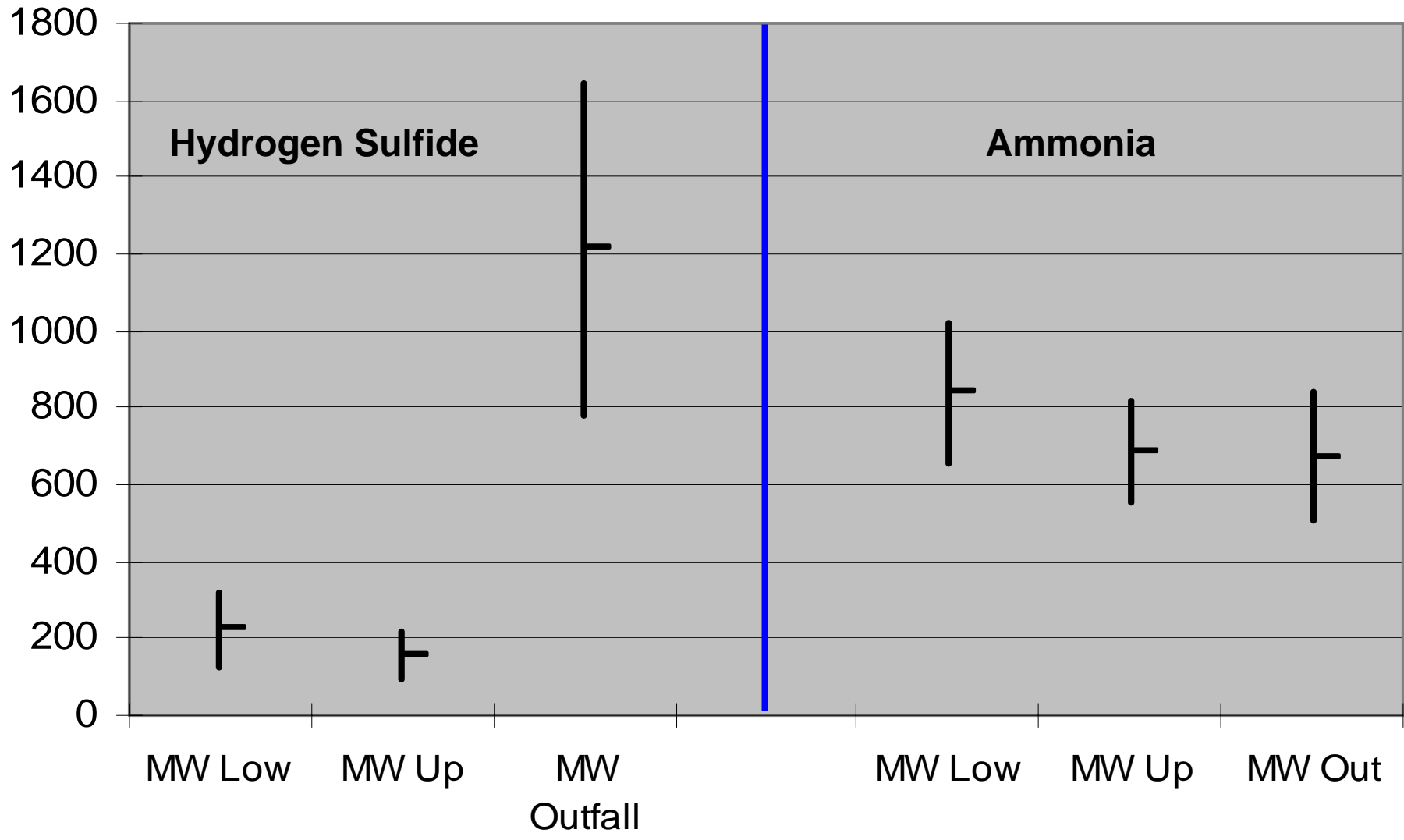
BUT...

DISPLAY INDICATORS

CIG Air Monitoring Project Conclusions

- **Agitated areas (sand channels and outfalls) behave as a point source for H₂S**
- **Local concentrations may exceed recommended occupational exposure levels**
- **Very discrete concentrated plumes may develop. Downwind magnitude and effect of these plumes unknown.**
- **Inversions may cause widespread local exceedences of occupational exposure limits. Extent unknown.**

Effect of Outfall on Near Lagoon Ambient Concentrations



Ambient Air Concentrations
Daytime Levels

Manitowoc County
October 15, 2007

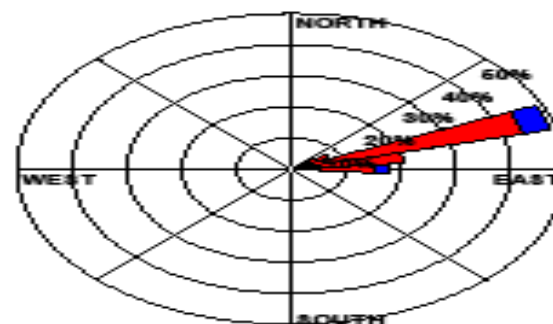
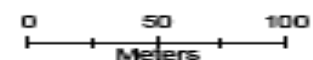


Field Sampling Measurements
(Micrograms per Cubic Meter)

Location	NH3	H2S
2	292	18
3	154	ND
6	229	27
7	186	21
8	ND	ND
9	70	ND
10	221	67
11	359	1343
12	567	143
13	472	75
14	453	48
16	236	ND
18	755	45
18	806	76
20	126	145
23	ND	ND
25	ND	ND
27	ND	ND
33	ND	ND

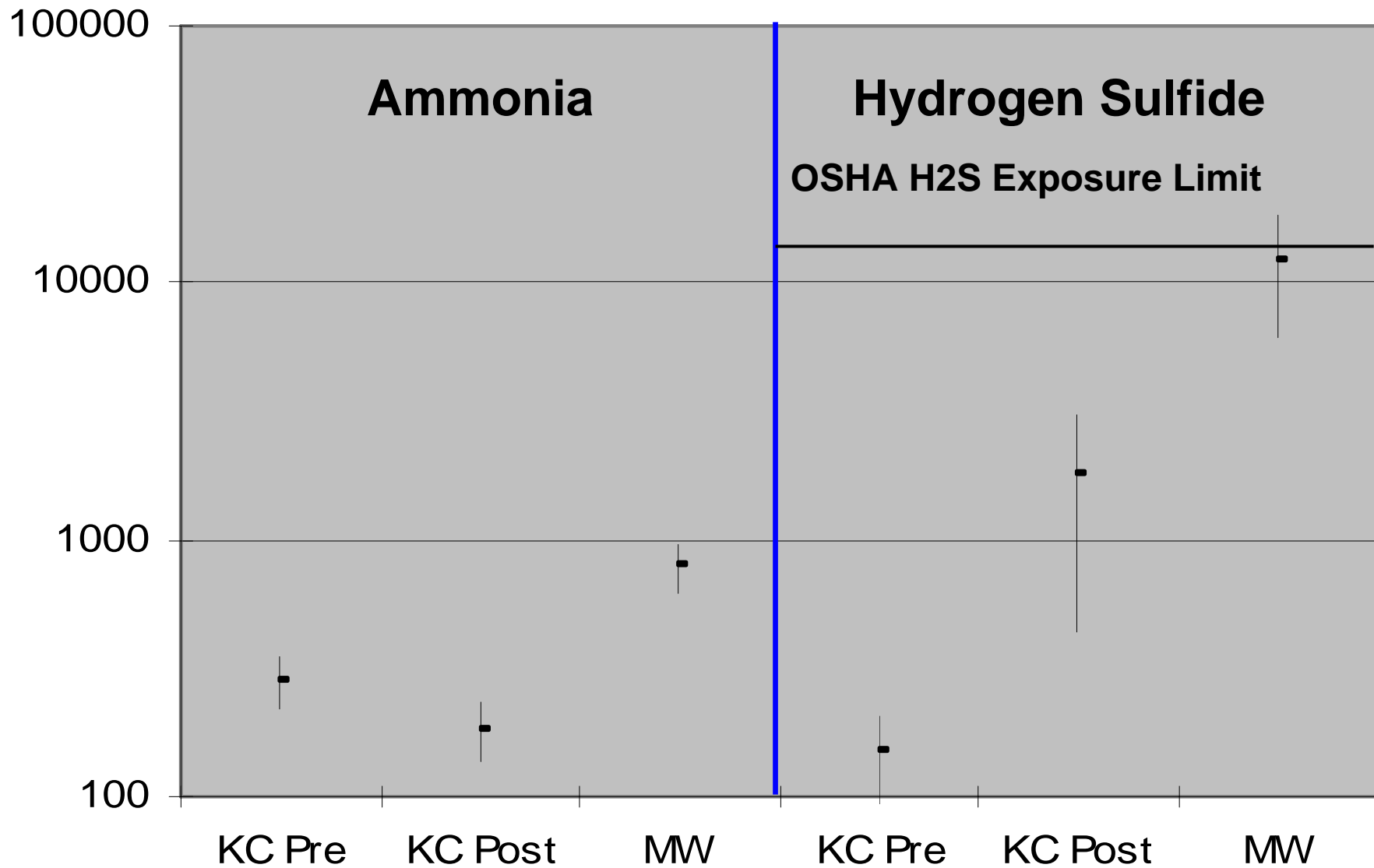
Note: ND = Non-Detect (detection limits vary with conditions)

- Ammonia
- Hydrogen Sulfide
- 10 Location Number



- WIND-SPEED (m/s)**
- >= 11.0
 - 8.0 - 11.0
 - 5.7 - 8.0
 - 3.6 - 5.7
 - 2.1 - 3.6
 - 0.0 - 2.1
- Scale: 60%

Sand Channel Observations



Ambient Air Concentrations

Nighttime Levels - Sand Separation Channel

Manitowoc County

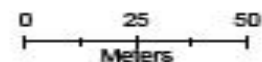
May 5-6, 2008



Field Sampling Measurements
(Micrograms per Cubic Meter)

Location	NH3	H2S
28	578	3881
29	517	18182
30	430	2335
31	310	720

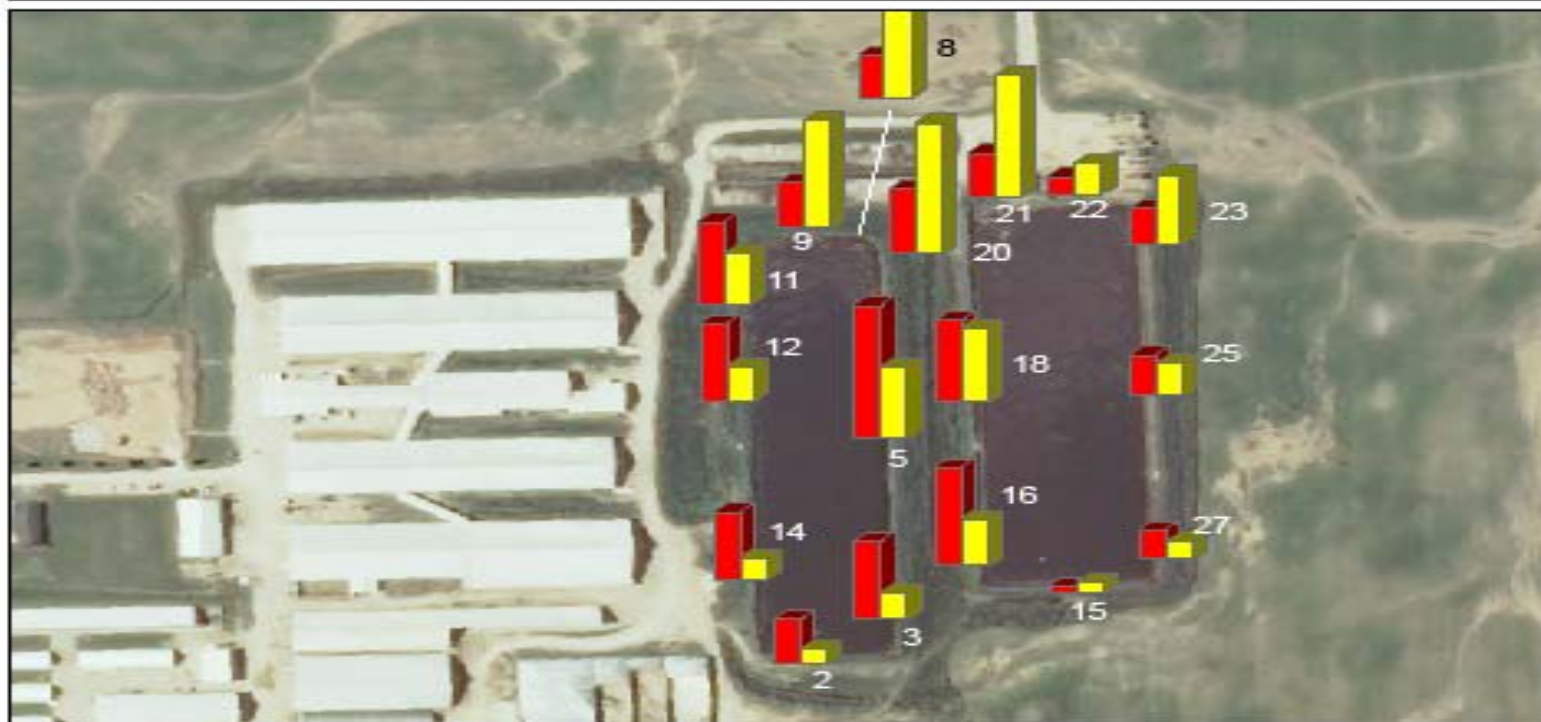
- Ammonia
- Hydrogen Sulfide
- 10 Location Number



- WIND SPEED (mph)
- 0 - 11.0
 - 11.1 - 15.1
 - 15.2 - 22.2

Ambient Air Concentrations Nighttime Levels

Manitowoc County
May 5-6, 2008

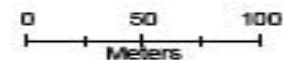


Field Sampling Measurements
(Micrograms per Cubic Meter)

Location	NH3	H2S
2	508	158
3	870	292
5	1505	796
8	489	1637
9	524	1238
11	934	574
12	888	391
14	766	235
15	ND	119
16	1116	526
18	927	849
20	735	1486
21	493	1393
22	201	357
23	404	795
25	457	368
27	327	199

Note: ND = Non-Detect (detection limits vary with conditions)

■ Ammonia
■ Hydrogen Sulfide
10 Location Number



WIND SPEED (mph)
■ 11.0 - 15.0
■ 6.0 - 11.0
■ 3.0 - 6.0
■ 2.0 - 3.0
■ 0.0 - 2.0
 Contour: 2.0%

Project Completion



- **Complete Final Report Available at:**
<http://www.datcp.state.wi.us/arm/agriculture/land-water/odor/index.jsp>
- **Department considers CIG results to indicate a fenceline study is needed to better understand ag waste emissions**

Agricultural Waste Emissions Fenceline Study

**DNR intends to monitor property line
concentrations of NH₃ and H₂S in 2010**

**deally, 5 or 6 farms: 2 or 3 dairies, beef, poultry
and swine**

**A combination of passive and active sampling
methods**

Currently evaluating volunteer farms