



FHWA & EPA MSAT National Near-roadway Measurement Study

MTAQS 2009 – Grafton, Illinois

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and Don Whitaker*



U.S. Department of Transportation
Federal Highway Administration

SAFETEA-LU

Safe, Accountable, Flexible, Efficient Transportation Equity Act:
A Legacy for Users



Outline

- Lawsuit Settlement Agreement
- FHWA Protocol
- EPA Interagency Agreement & Pooled Fund
- Implementing Monitor Protocol & Challenges
- Las Vegas Site Characteristics
- Preliminary NAAQS Trends
- Preliminary MSAT Trends
- Proposed Next Site
- Summary



Lawsuit and Settlement Agreement: Background

- Nevada DOT – Widening US 95
- FHWA and NDOT Sued
- FHWA and NDOT Won
- Sierra Club Appealed
- We Reached a Settlement Agreement
- Sierra Club Dropped the Appeal



Settlement Agreement Continued

- NDOT Agreed to do monitor and filtration study at near-by schools
- FHWA Agreed to monitor concentrations of MSAT in the near road environment

<http://www.fhwa.dot.gov/environment/airtoxicmsat/setagree.pdf>



Monitoring Protocol

Pollutants (CO, NO, Black Carbon, PM_{2.5}, Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, DPM, Formaldehyde)

Methodologies & Measurements

Distances (10 m, 100 m, 300 m and background/upwind)

Schedule (Continuous and Canister Samples – nine 1-hour samples every 12 days)



EPA Interagency Agreement & Pooled Fund

EPA & FHWA Interagency Agreement

- Monitoring in Las Vegas began December 2008, Southeastern Michigan monitoring to begin in Spring 2010. Together we have over \$3 m invested or planned over the next 15 months

Pooled Fund

- To date we have 6 states contributing funds (AZ, CA, MI, NV, NY and WI)



Experience Using Monitoring Protocol

Monitor Citing Challenges

- Access
- Electricity
- Security
- Predominate Winds
- Near by sources
- Roadway configuration
- Traffic Data

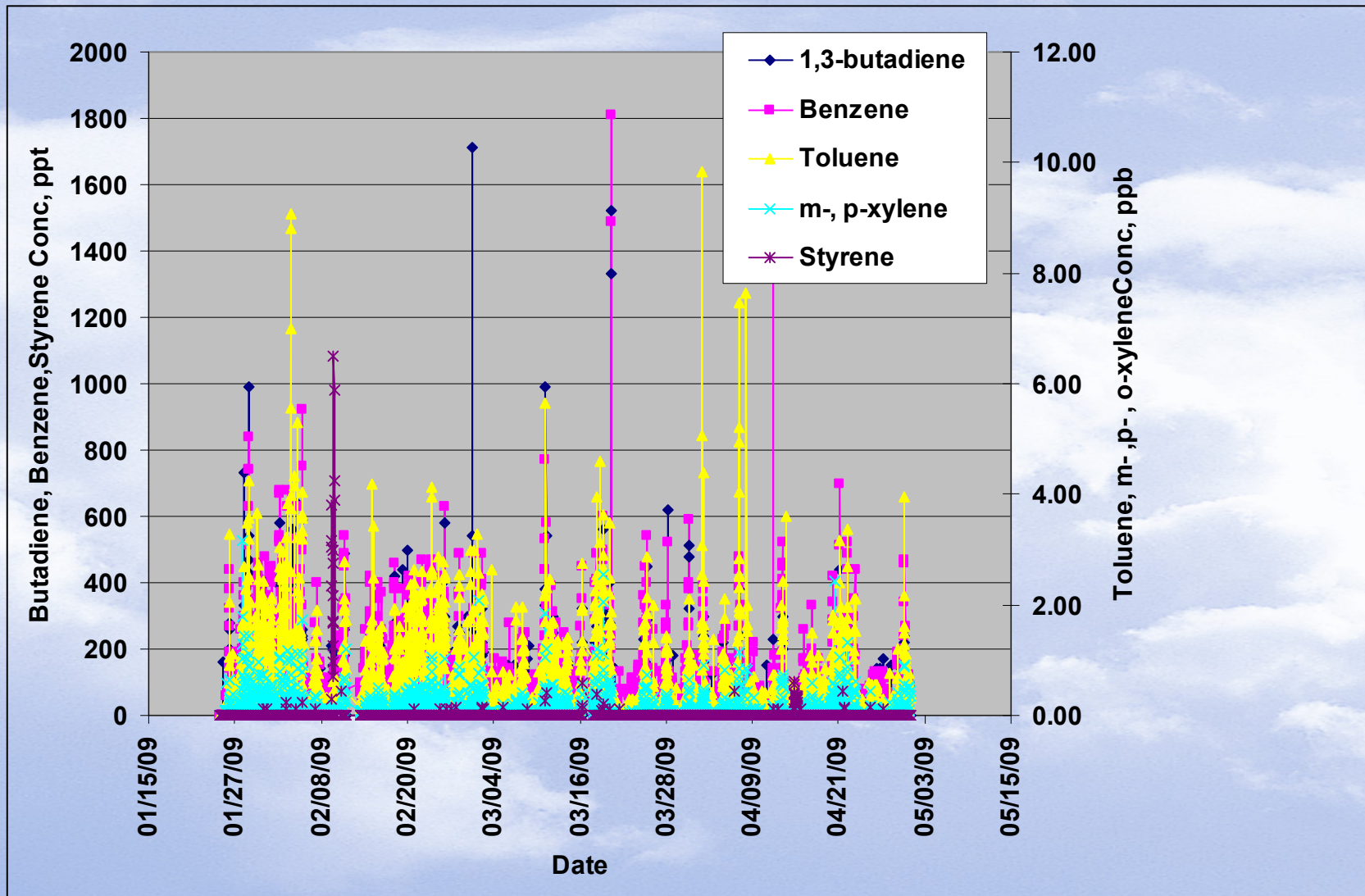


Experience Using the Monitoring Protocol

Enhancements in Data Collection with semi-continuous gas chromatography (GC)



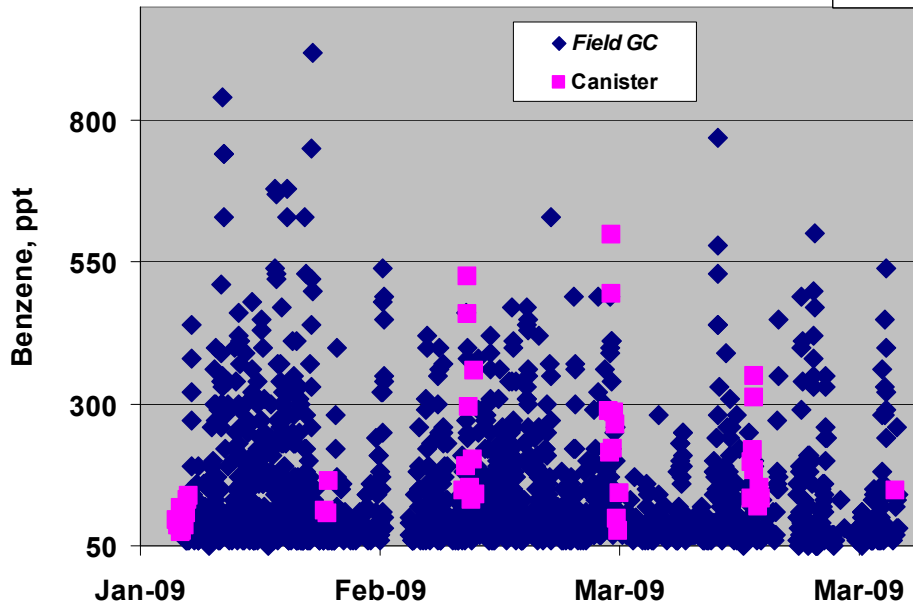
GC Measurement Data (Preliminary)



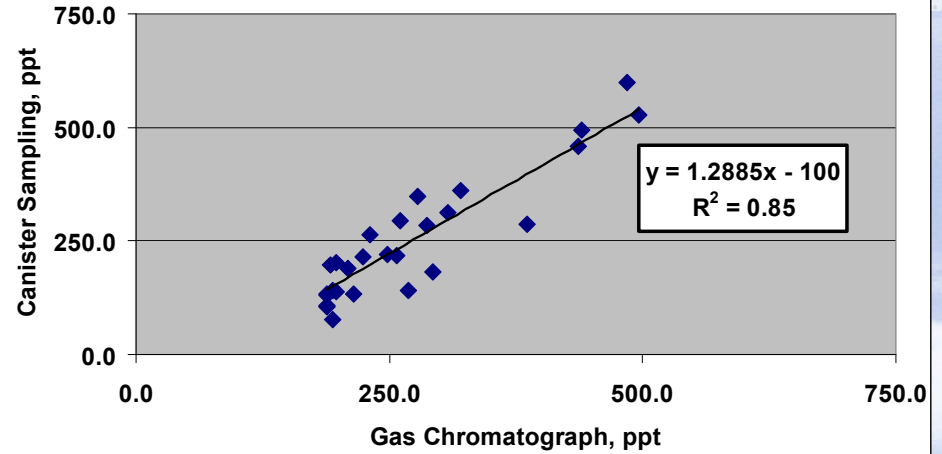


GC Comparison to Canister Preliminary Results - Benzene

Field GC and Canister Data Comparison



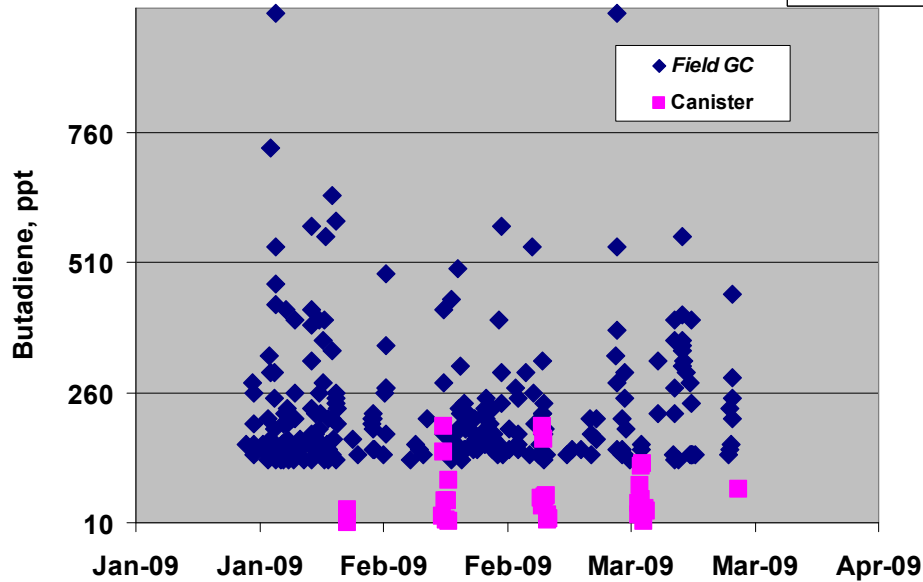
Benzene, No Zero Data



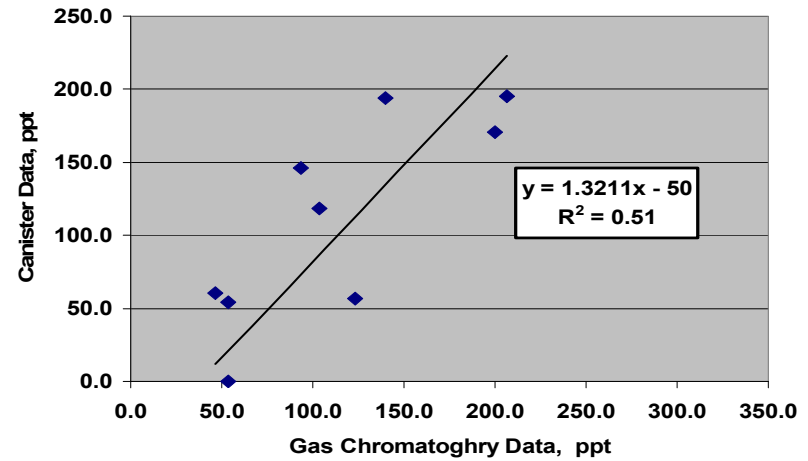


GC Comparison to Canister Preliminary Results - Butadiene

Field GC and Canister Data Comparison



Butadiene, No Zero Data



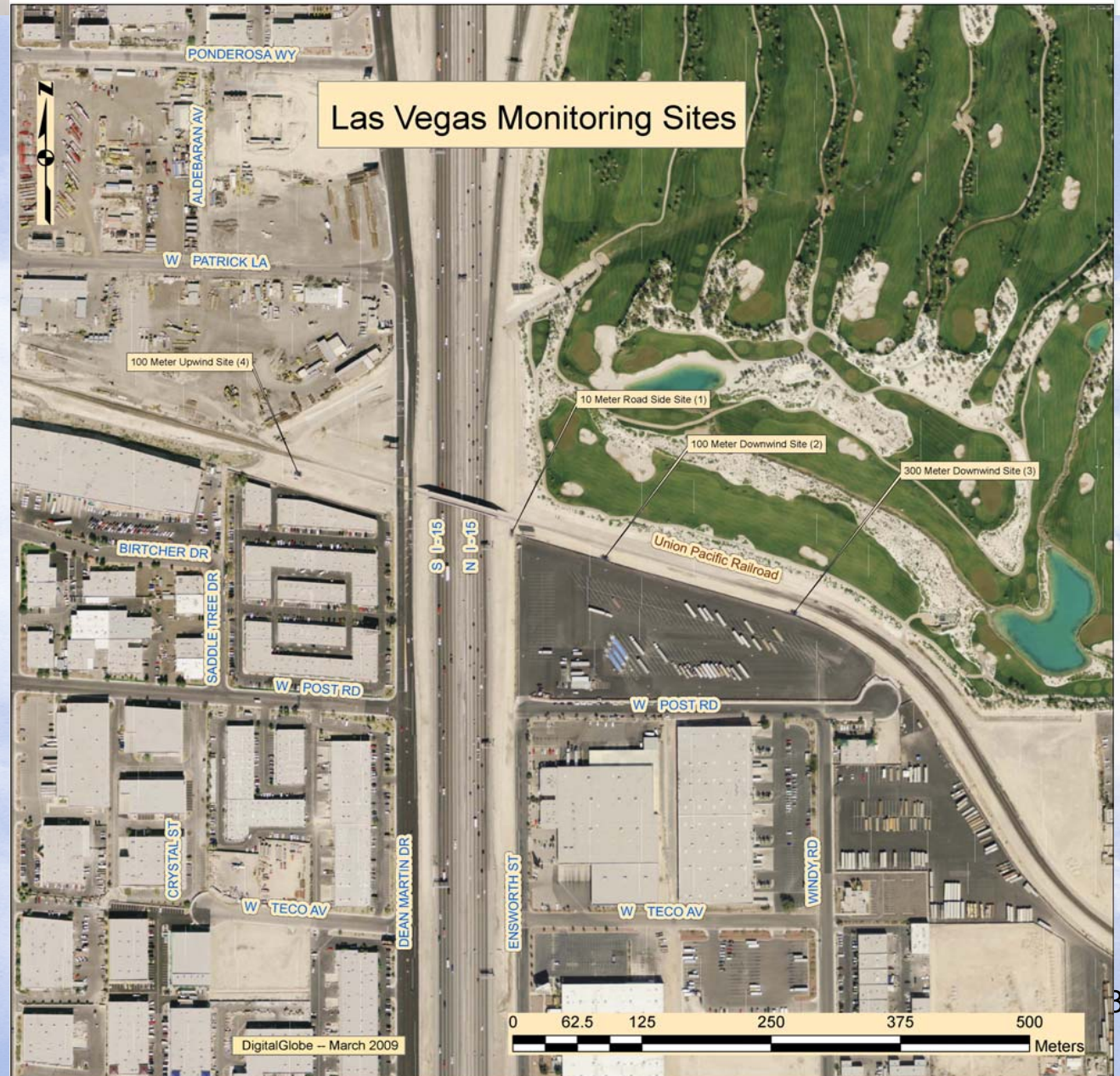


GC Evaluation Summary

- **Acceptable comparison to the TO-15 method.**
- **Acceptable comparison to the canister results.**
- **Significant operational savings.**
- **Continuous data – 30 min cycles.**
- **Purchase and install GCs in the additional shelters.**
- **Continue evaluation of the GCs**



Las Vegas Monitoring Site I-15





I-15 Site View at Grade

North View



West View



East View





Instrument Deployment - Overview

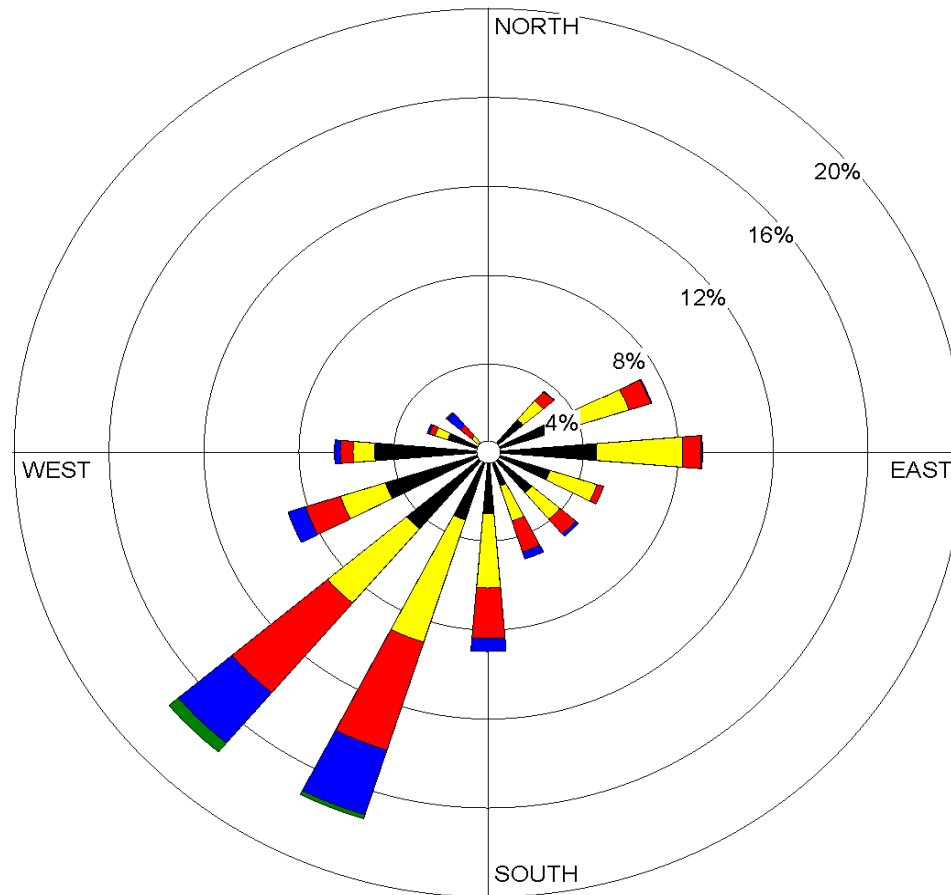
Core Instruments	10 Meters @ Roadside	100 Meter Downwind	300 Meter Downwind	100 Meter Upwind
TO-11A Cartridge sampling	X	X	X	X
TO-15 Canister sampling	X	X	X	X
Continuous GC	X	X	X	X
Continuous gas monitoring (CO, NO _x)	X	X	X	X
Continuous gas monitoring (SO ₂)		X		X
Continuous black carbon monitoring (Aethalometer)	X	X	X	X
Continuous fine particle (TEOM)	X	X	X	X
Integrated PM _{2.5} (FRM)	X	X	X	X
Continuous Particle Counts (TSI, 6nm – 3µm)	X	X	X	X
Wind speed/wind direction (sonic anemometer)	X	X	X	X
Meteorological monitoring (temp, RH, solar, etc.)		X		
Cut Section Monitoring (3-CO & 3-Aethalometers)	X			

Data Type	Pollutant or Covariate	Method	Sample Type and Frequency
Mobile Source Air Toxics	Benzene 1,3-butadiene	TO-15	1-hour integrated 1-in-12 day schedule 9 samples each day at each road-side location
	Formaldehyde Acetaldehyde Acrolein	TO-11A	
Mobile Source Related Air Pollutants	CO	NDIR	Continuous
	NO, NO ₂ , NO _x	Chemiluminescence	
	SO ₂	Fluorescence	
	Black carbon	Aethalometer	
	PM _{2.5}	TEOM	
	PM ₁₀		
	Particle count	CPC	
	PM _{2.5}	FRM	24-hour integrated 1-in-12 day schedule 1 sample each day at each road-side location
Traffic	Vehicle count Speed Length	Radar	Continuous
Meteorology	Wind speed/direction; Temperature Relative humidity	RM Young Sonic Anemometer; Vaisala Temp/Humidity	Continuous

Wind Rose Plot – 2nd Quarter Data

WIND ROSE PLOT:
Near Road Monitoring Site - Met Data

DISPLAY:
Wind Speed
Direction (blowing from)



WIND SPEED
(Knots)

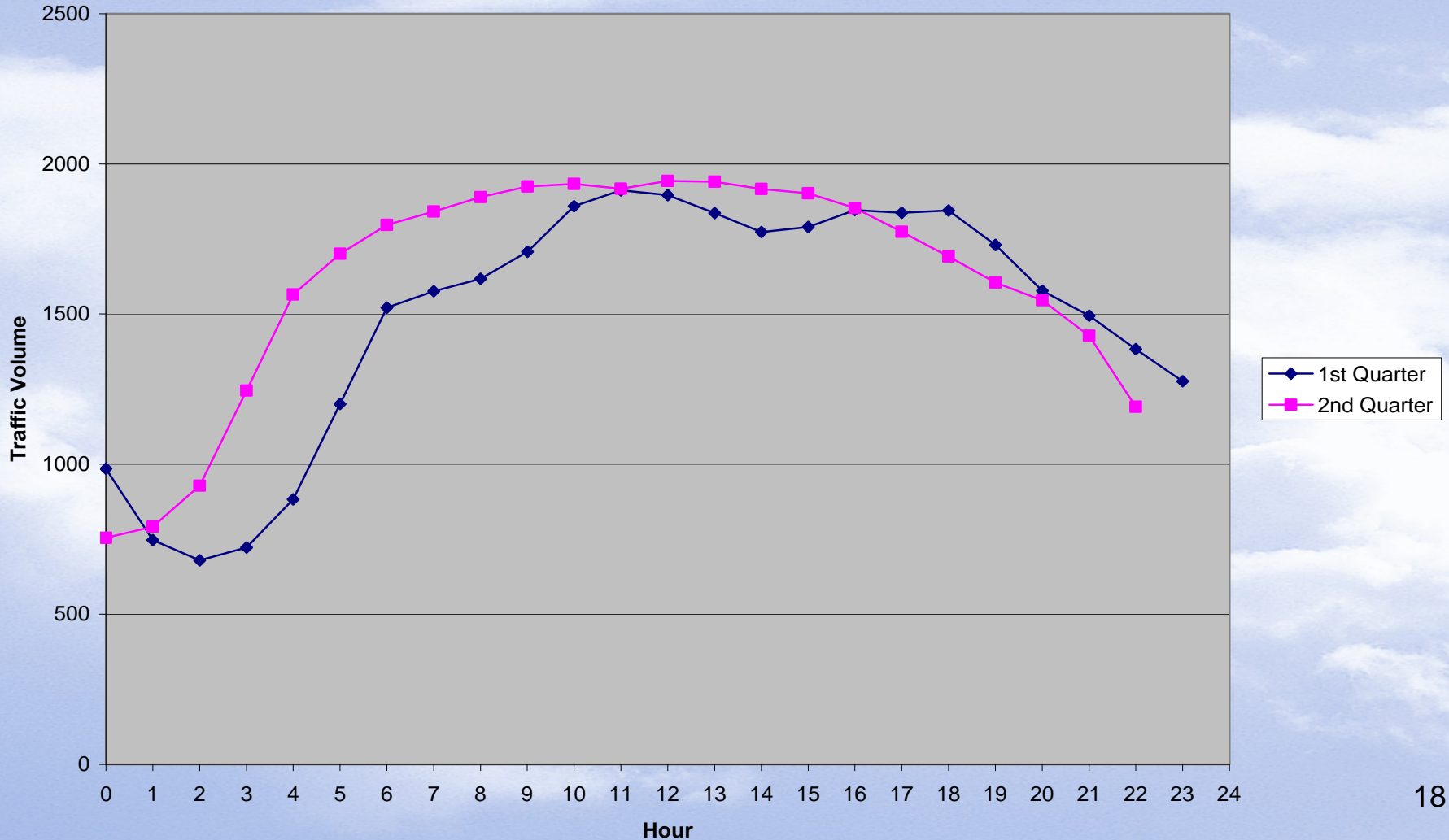
- >= 22
- 17 - 21
- 11 - 17
- 7 - 11
- 4 - 7
- 1 - 4

Calms: 0.00%

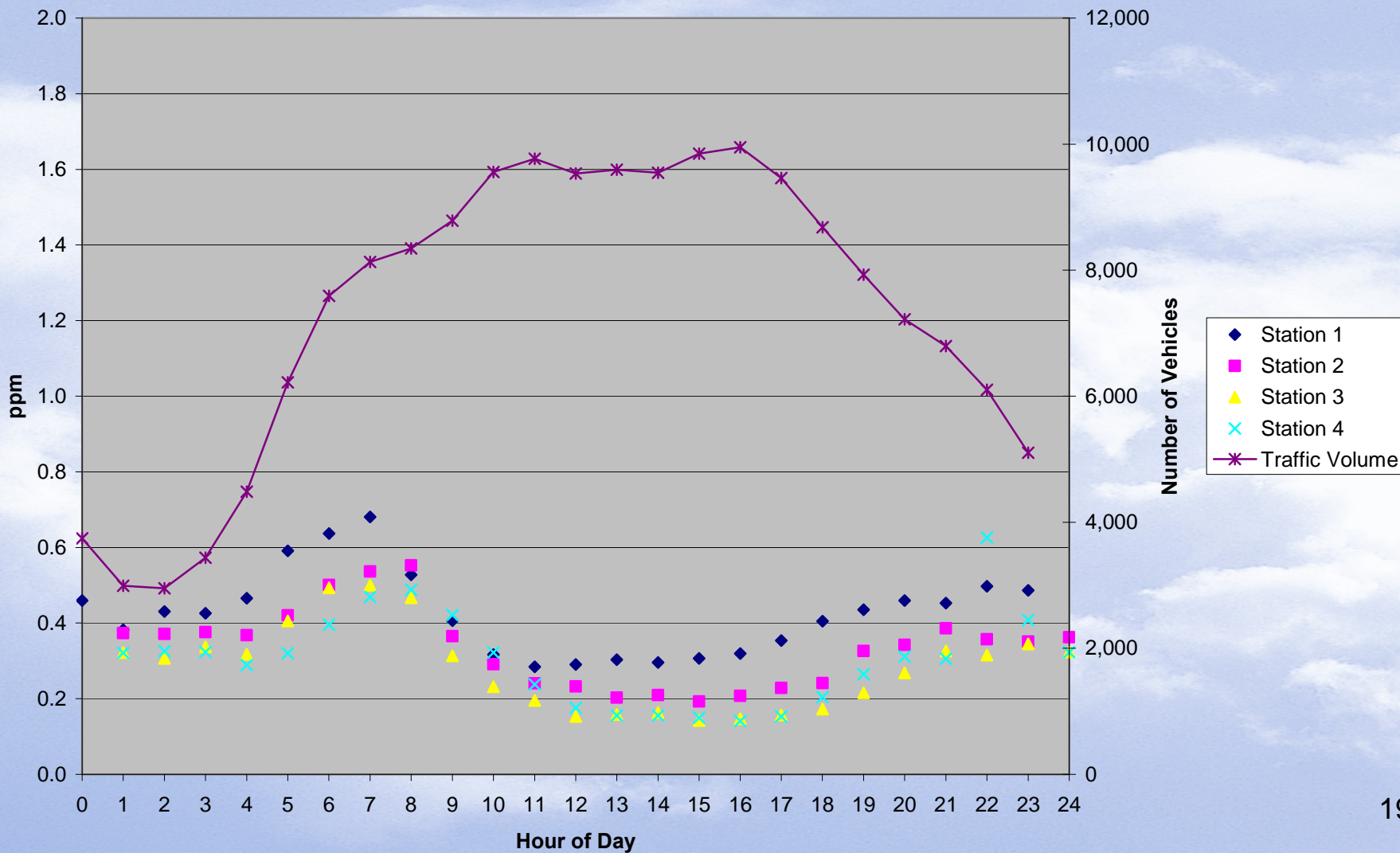


Preliminary Data

Mean Traffic Volume by Hour

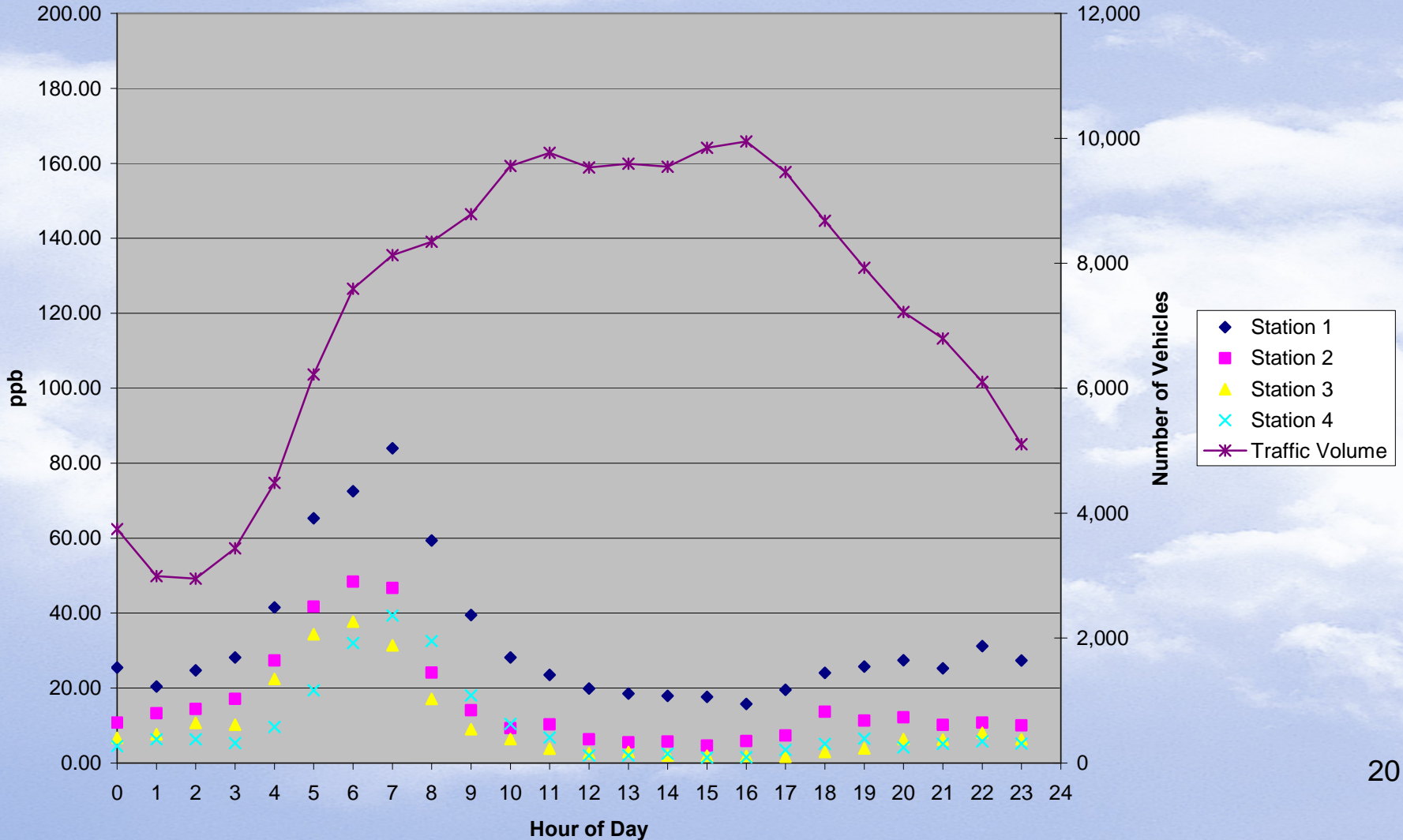


Preliminary Data, Wind Speeds Not Charted, All Winds from Road
Mean CO vs. Traffic Volume by Hour of Day



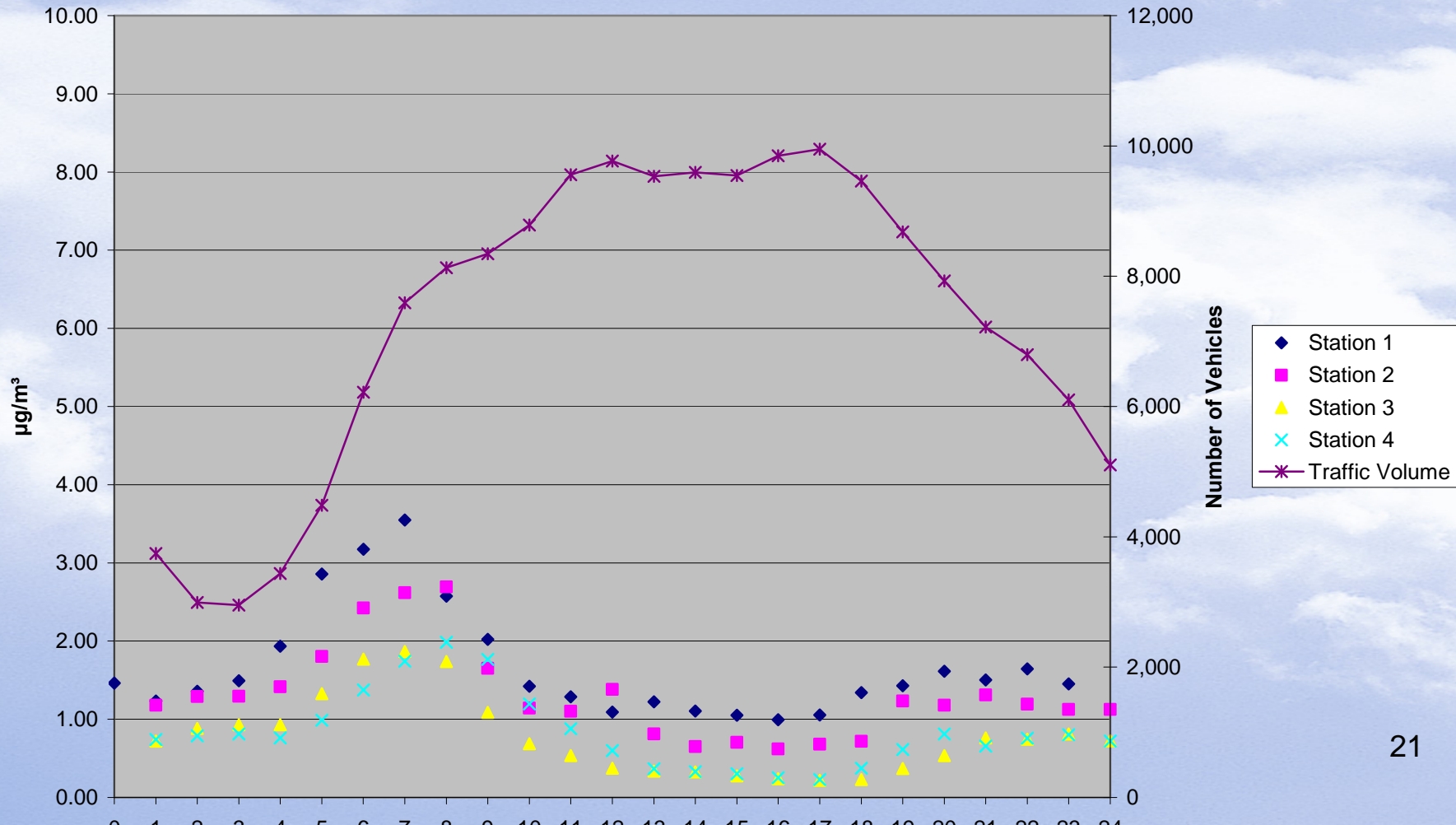
Preliminary Data, Wind Speeds Not Charted, All Winds from Road

Mean NO vs. Traffic Volume by Hour of Day



Preliminary Data, Wind Speeds Not Charted, All Winds from Road

Mean Black Carbon vs Traffic Volume by Hour of Day





Note: Preliminary Data,
Winds from Road;
Canister Samples Only.

**Approximately
72 samples**

Mean 1,3 Butadiene Ratio

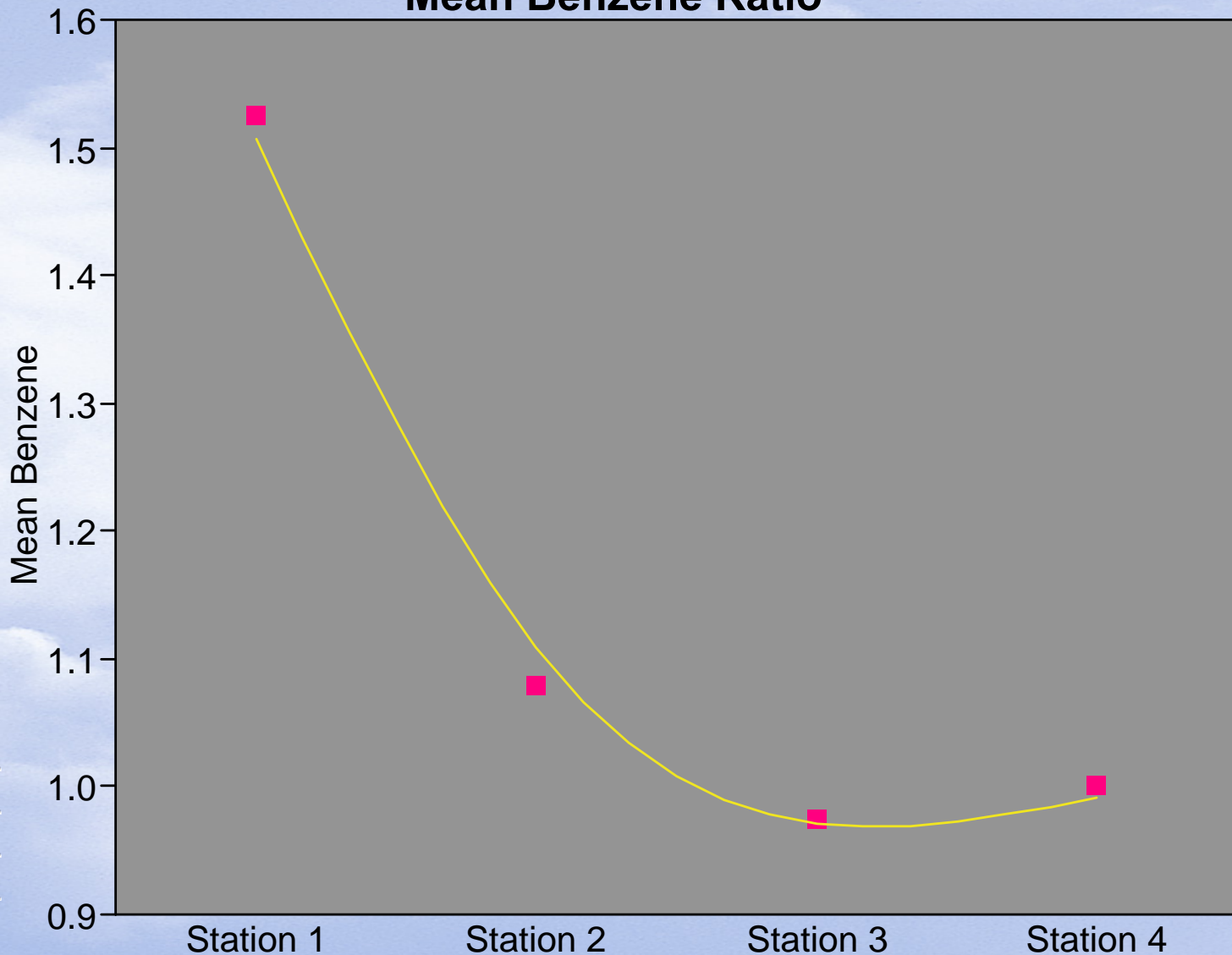


Ratio of:
Station 1 to Station 4
Station 2 to Station 4
Station 3 to Station 4
Station 4 to Station 4

Mean Benzene Ratio

Note: Preliminary Data,
Winds from Road;
Canister Samples Only.

**Approximately
72 samples**



Ratio of:
Station 1 to Station 4
Station 2 to Station 4
Station 3 to Station 4
Station 4 to Station 4



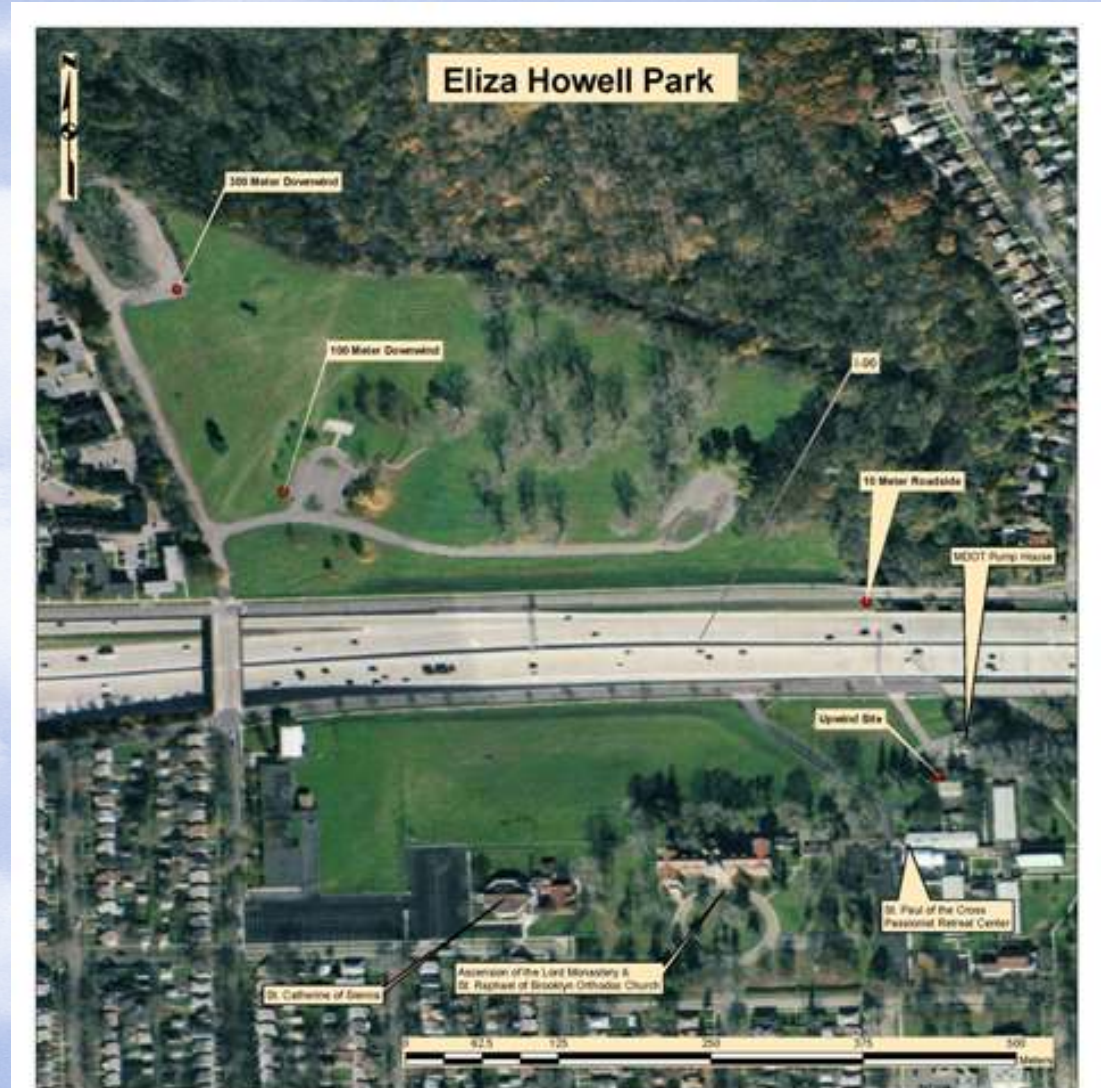
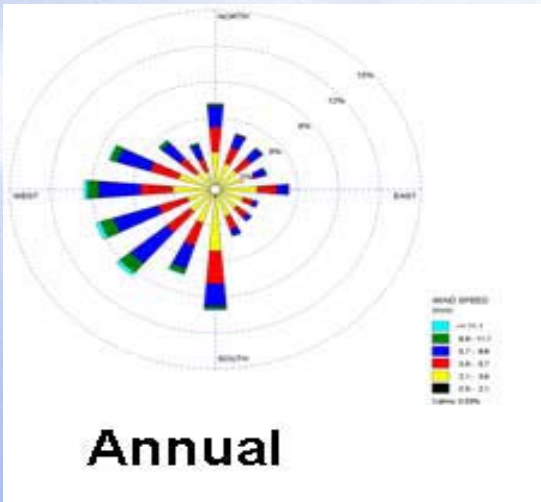
Sensitivities and Limitations

- Gas v. Diesel
- Other



Proposed Next Site – Detroit, MI

- I – 96
- > 150,000 AADT
- Terrain
- Confounding factors
- Background/Upwind Site
- Winds





Summary

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Contact Information/Questions?

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