



Integration of Gas Chromatographs into the FHWA/Environmental Protection Agency Near Road MSAT Study in Las Vegas, NV

Richard C. Shores, Alan F. Vette, Sue Kimbrough, Donald A. Whitaker, Victoria Martinez, Kevin N. Black, Richard Baldauf, Daniel A. Vallero,,



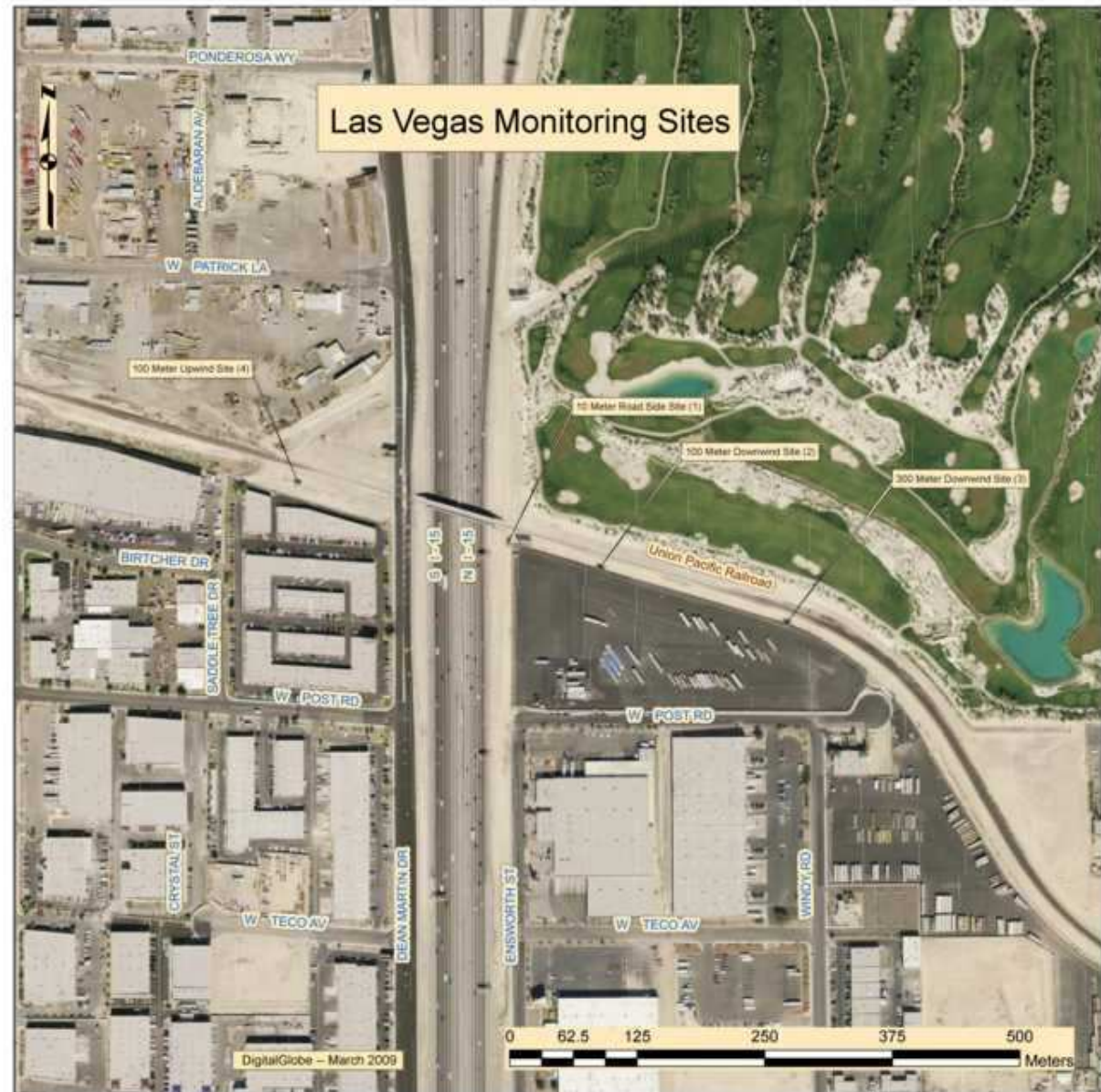


Background – Identification of Research Problem

- **FHWA Protocol specified the use of EPA methods TO-15 and TO-14 sampling methods for the measurement of MSAT's.**
 - **The cost of labor, analysis and shipping limit the number of samples collected. The protocol specified one sample day for every twelve days of operation; four sites with QC require 1200 plus samples.**
- **Gas chromatography with PID detector**
 - **After the cost of initial purchase, the GC must be reliable, provide self contained operation, and continuous data in a usable format. This presentation is reporting on the field evaluation of a GC**

Field Monitoring Location

- **Sierra Club sued FHWA**
 - **NEPA process, no established criteria to include MSATs**
 - **FHWA has developed a tiered approach**
- **Unobstructed view of 400 meters**



Field GC Description

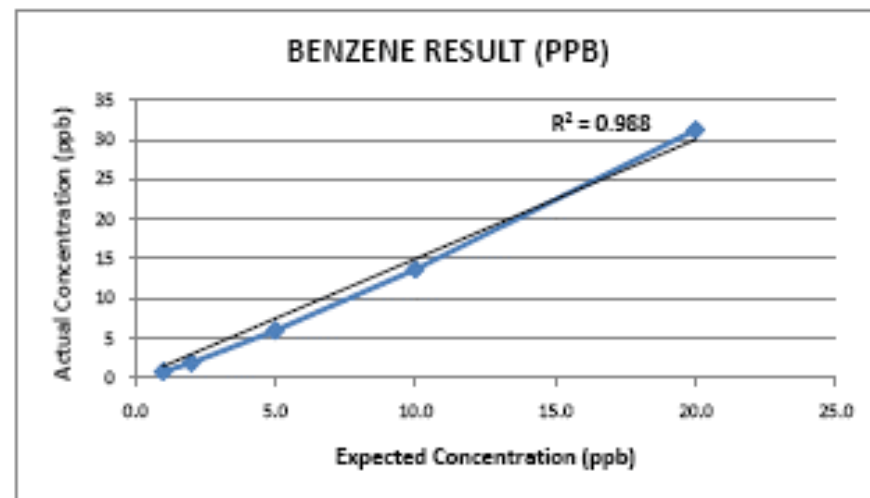
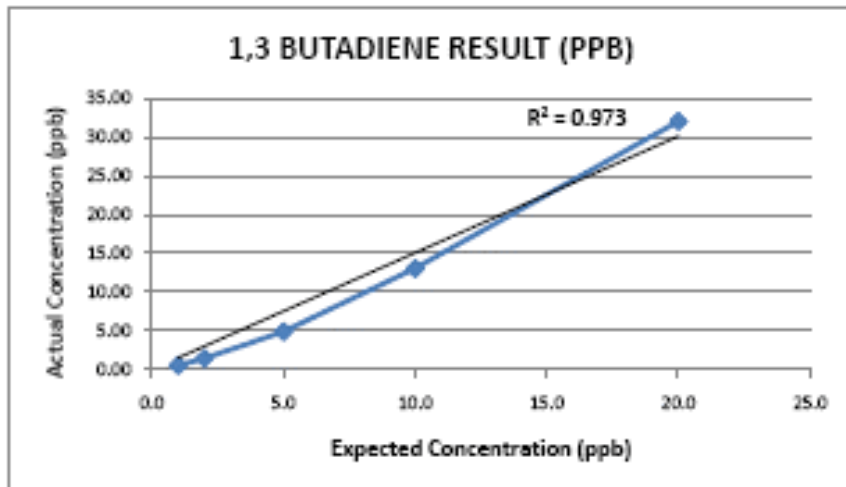
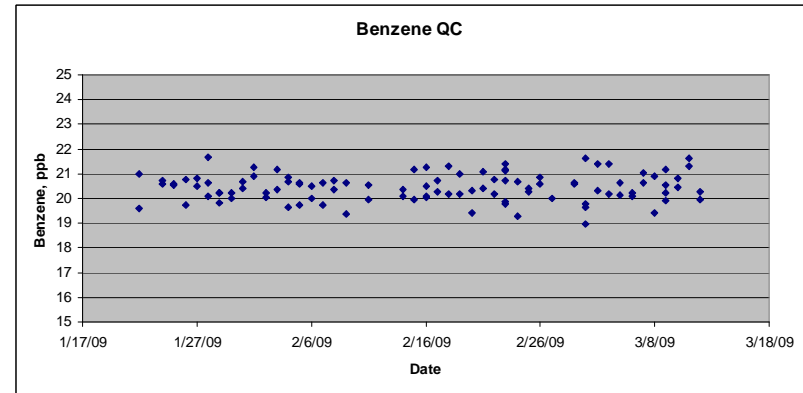
BTEX SYSTEM	
Column Type	Metallic, L=30m, id=0.28mm
Actuator Valve	6 port, pneumatic
Detector type	Photo Ionization Detector (PID), 10.6eV Lamp
Carrier gas	Nitrogen
Trap type	Carbotrap
Thermo-Desorption Temperature	380°C
Cycle time	15 to 30 minutes
Detection Range	0.3 to 320 µg/m³
Detection Limit	10 ppt
Relative standard deviation on concentration	<3%
Relative standard deviation on retention time	<0.3%
Calibration	Benzene Permeation Tube, Fully automatic, self adjustable
Optimized	Flows, normalized lamp response, network capable and ASCII output files for both calibration and measurement data.

GC Evaluation Procedure

- **Comparison to the TO-15 criteria**
 - **Method detection limit of ≤ 0.5 ppb, replicate precision within 25 percent, accuracy within 30 percent**
- **Comparison to the canister results**
 - **Method detection limit of ≤ 0.5 ppb, replicate precision within 25 percent, accuracy within 30 percent**
- **Operate one GC in the field while canister samples are collected**
 - **Decide if the purchase of three additional GCs is justified**

Calibration and QC Control

Conc., ppb, 1/23/09	n, points	Butadiene Avg/Std	Benzene Avg/Std
1	7	0.53/0.12	0.81/0.18
2	13	1.42/0.12	1.93/0.09
5	4	4.87/0.39	6.0/0.47
10	8	13.03/0.74	13.68/0.53
20	8	32.01/2.47	31.19/1.61

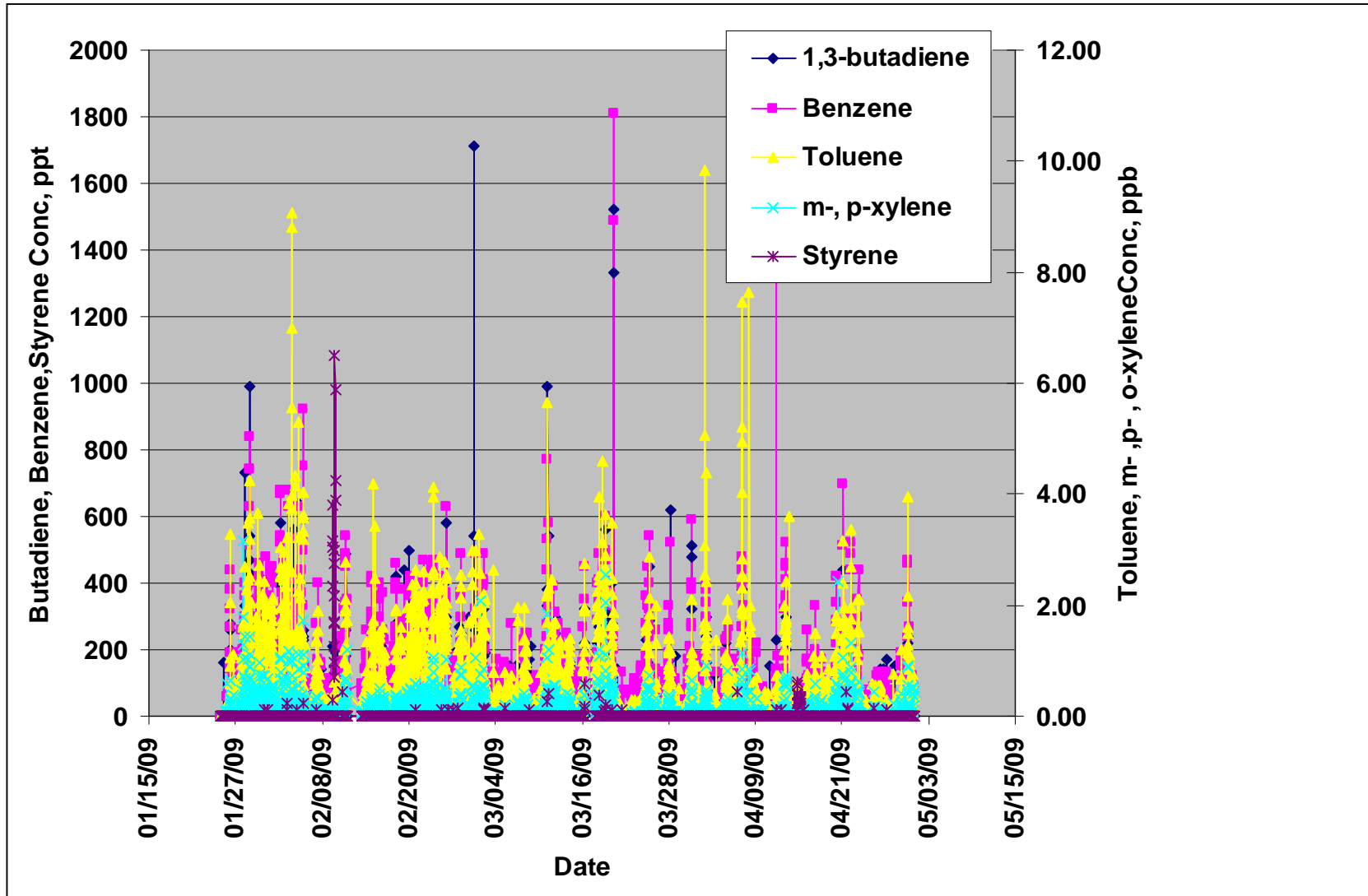




GC Comparison to TO-15 Method

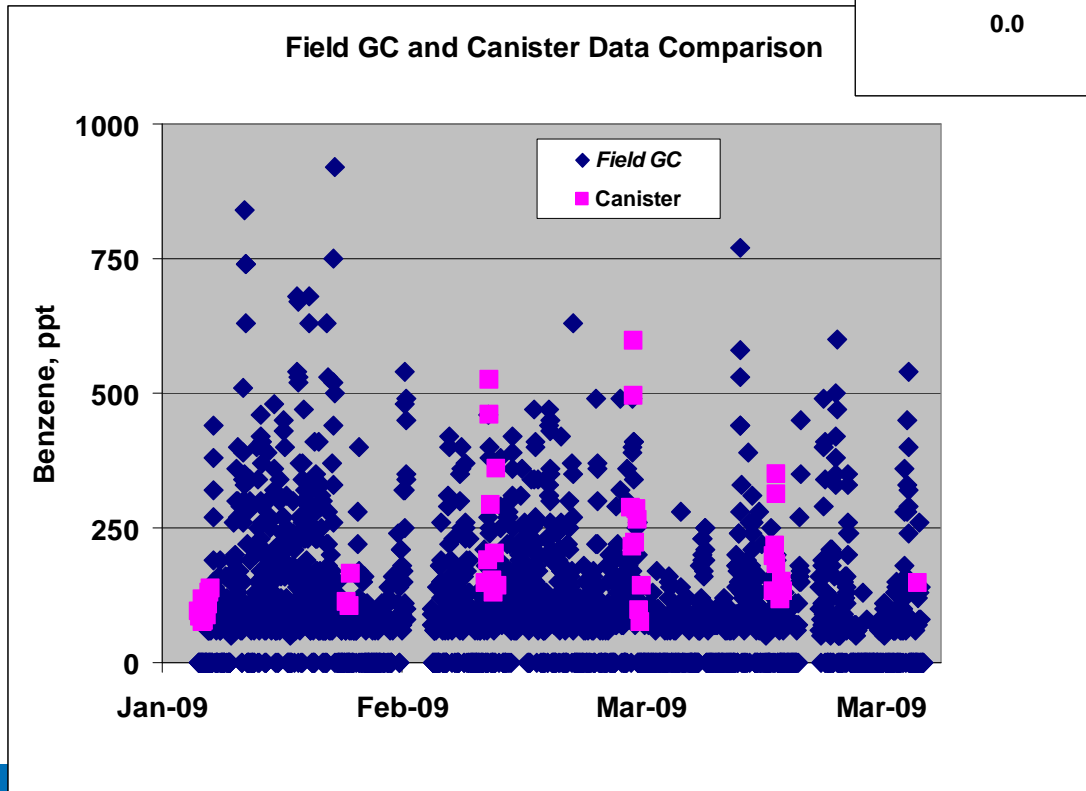
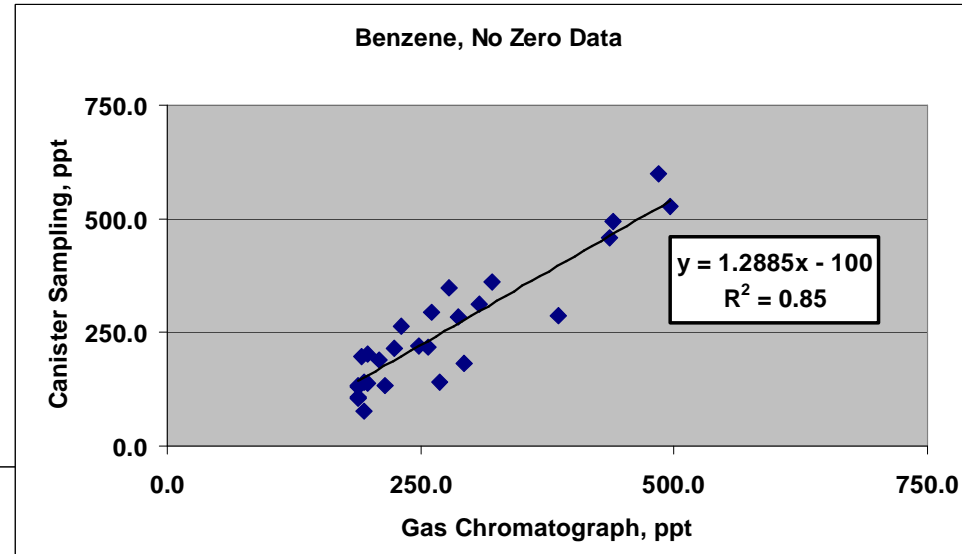
- **Method detection limit for 1,3-butadiene and benzene ranged from 0.28 to 0.57 ppb, calculated for 1 and 2 ppb. Method specifies 0.5 ppb.**
- **Average method detection limit of 0.4 ppb.**
- **Precision results are within 6 percent, calculated for 20 ppb. Method specifies 25 percent.**
- **Accuracy better than 30 percent. Method specifies 30 percent.**

GC Measurement Data

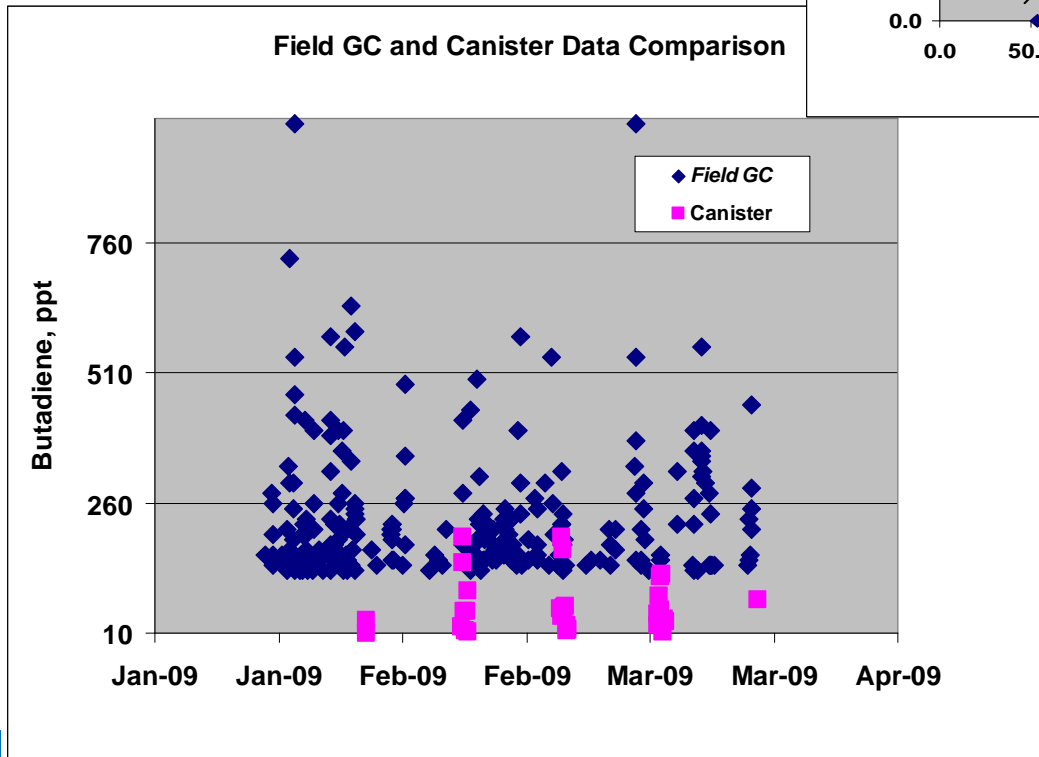
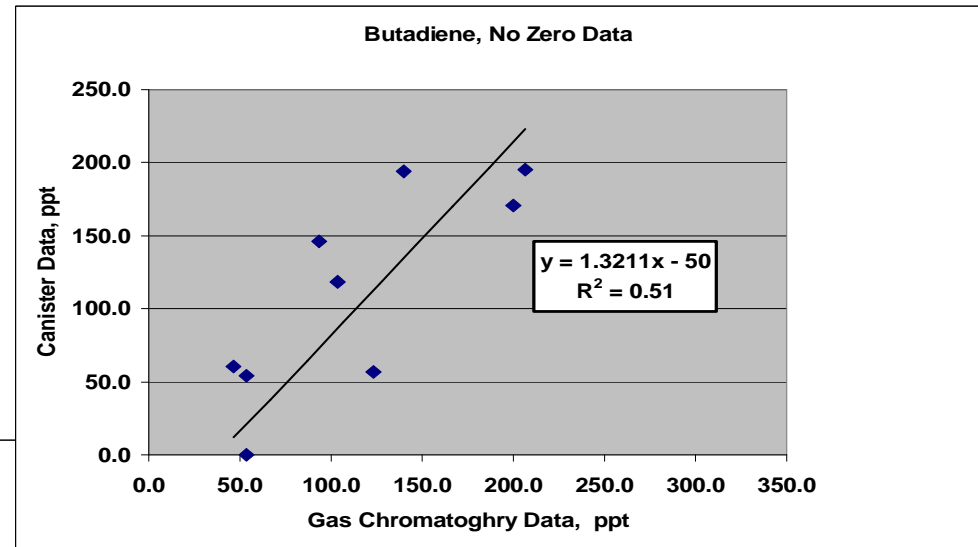


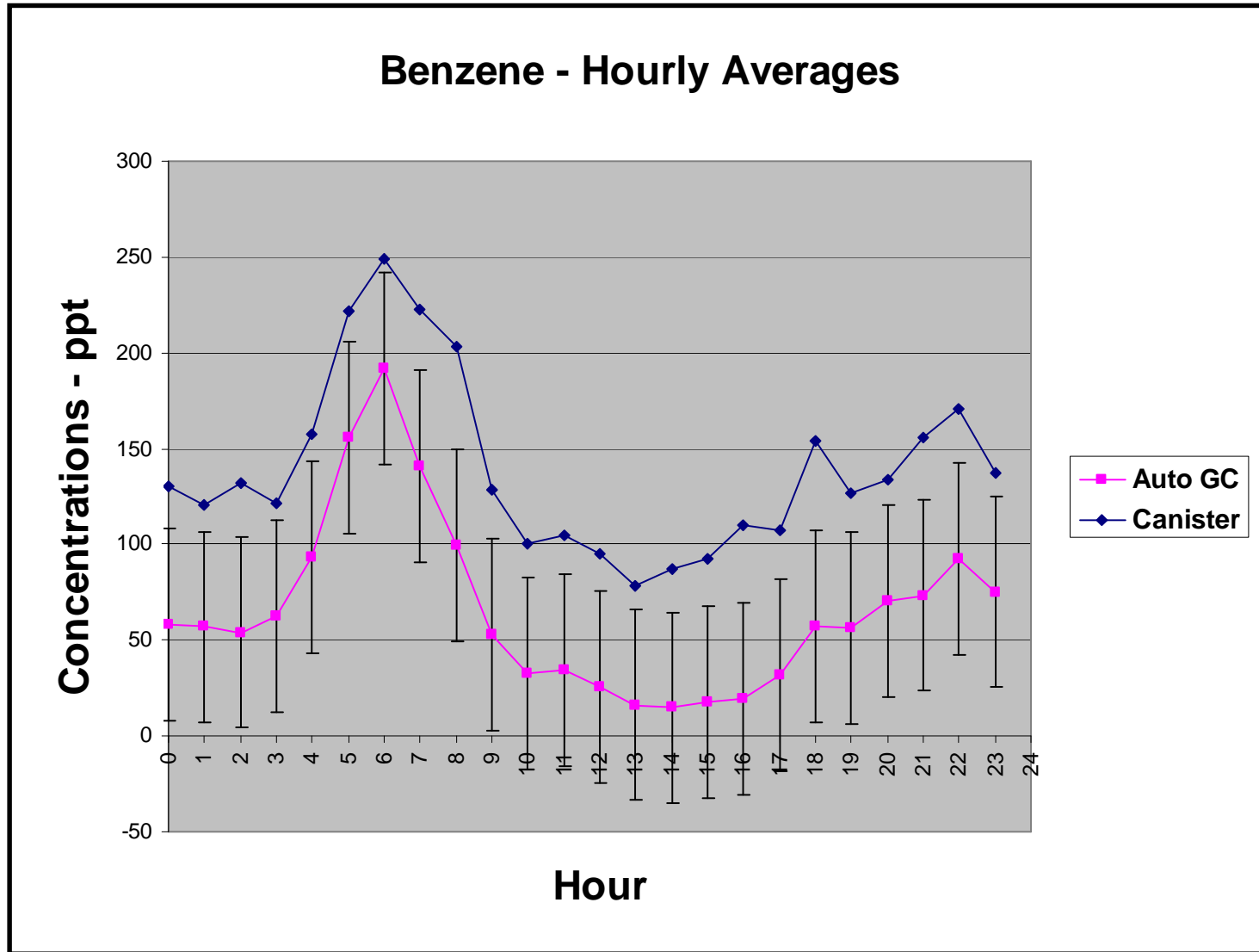


GC Comparison to Canister Results - Benzene



GC Comparison to Canister results - Butadiene







Canister Results Evaluation

- **Majority of the 1,3-butadiene and benzene concentrations have been less than 2 ppb**
- **Accuracy on average 30% for both butadiene and benzene**
- **Significantly more data, 43 canister samples versus 1200 benzene concentrations from the GC**
- **Canister method detection limit ~40 ppt and GC method detection limit ~ 100 ppt**
- **The GC has been operating for the past six months, unattended, data is down loaded remotely**
- **Three more GC's are being purchased to install in the remaining three sites**



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 canister sampling for QA/QC verification but reduce the number of samples taken.**



Acknowledgements

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