The City of Houston's Mobile Ambient Air Monitoring Laboratory: Our Experiences with Local-Scale Air Monitoring

Mobile Laboratory Program Team:

James Rhubottom, Jr., Dr. Youjun Qin, Dr. Peter Chen

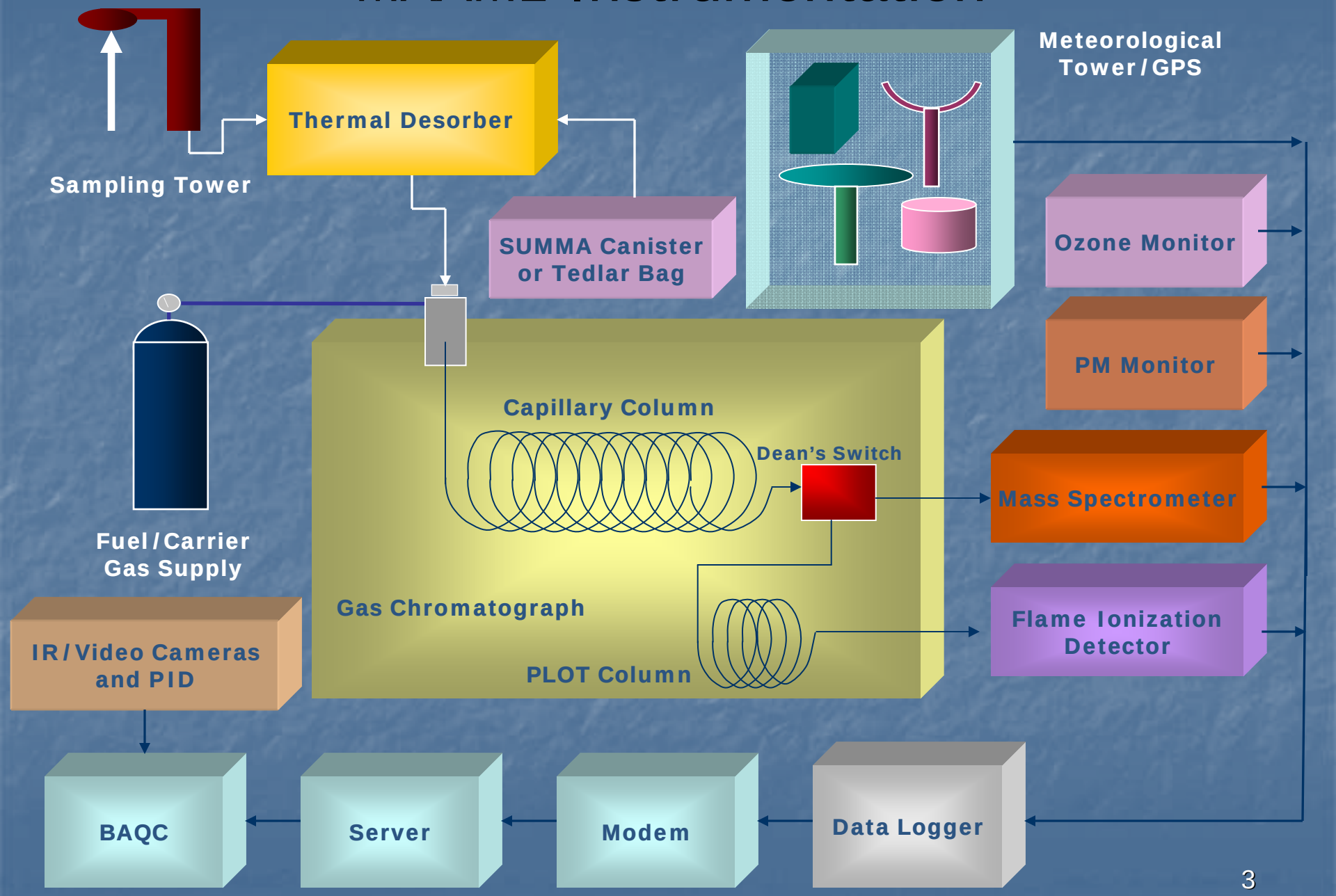
Program Manager: Dr. Wei-Yeong Wang

2009 NAAMC -04Nov09

The Bureau of Air Quality Control's (BAQC) Mobile Ambient Air Monitoring Laboratory (MAAML)

Funding provided by the U.S. EPA and the Houston Endowment, Inc.

MAAML Instrumentation



MAAML Instrumentation - Capabilities

- Meteorological Station
  - Wind Speed and Direction
  - GPS Position Data
  - Relative Humidity
  - Atmospheric Pressure
- Ozone Monitor
- Particulate Monitor
  - PM 10
  - PM 2.5
  - Particle Size Distribution Graphs (0.3 – 20 microns)

MAAML Instrumentation - Capabilities

- IR and Video Cameras
- GC/FID/MSD Analytical Platform (Field and Fixed-Base)
  - Analysis of calibrated VOC's
    - Near real-time ambient air analyses
    - SUMMA canister sampling and analysis
    - Tedlar bag sampling and analysis
  - Software library for identification of unknown VOC's
- Software Support
  - Forward and backward trajectories
  - Real-time concentration vs. time series plots for multiple pollutants of interest
  - Atmospheric modeling via incorporation of ISC3 model

The Case for Local-Scale Air Monitoring

- The proximity of residential and mixed-use zones to industrial applications from light to heavy necessitates an action plan for local-scale monitoring
  - Local-scale air monitoring can provide a more rapid response to unplanned emissions events in support of air quality issues
  - Citizen complaints help “drive the boat” in directing limited resources for monitoring runs
- Successes from local-scale monitoring becomes self-perpetuating
  - Accomplishments showcase impact of the team approach in resource allocation
  - Achievements can also bring about new ventures and opportunities to add value to existing air quality improvement efforts

The Case for Local-Scale Air Monitoring – Part 1

MAAML deployment at a local metal casting facility

The Case for Local-Scale Air Monitoring – Part 2

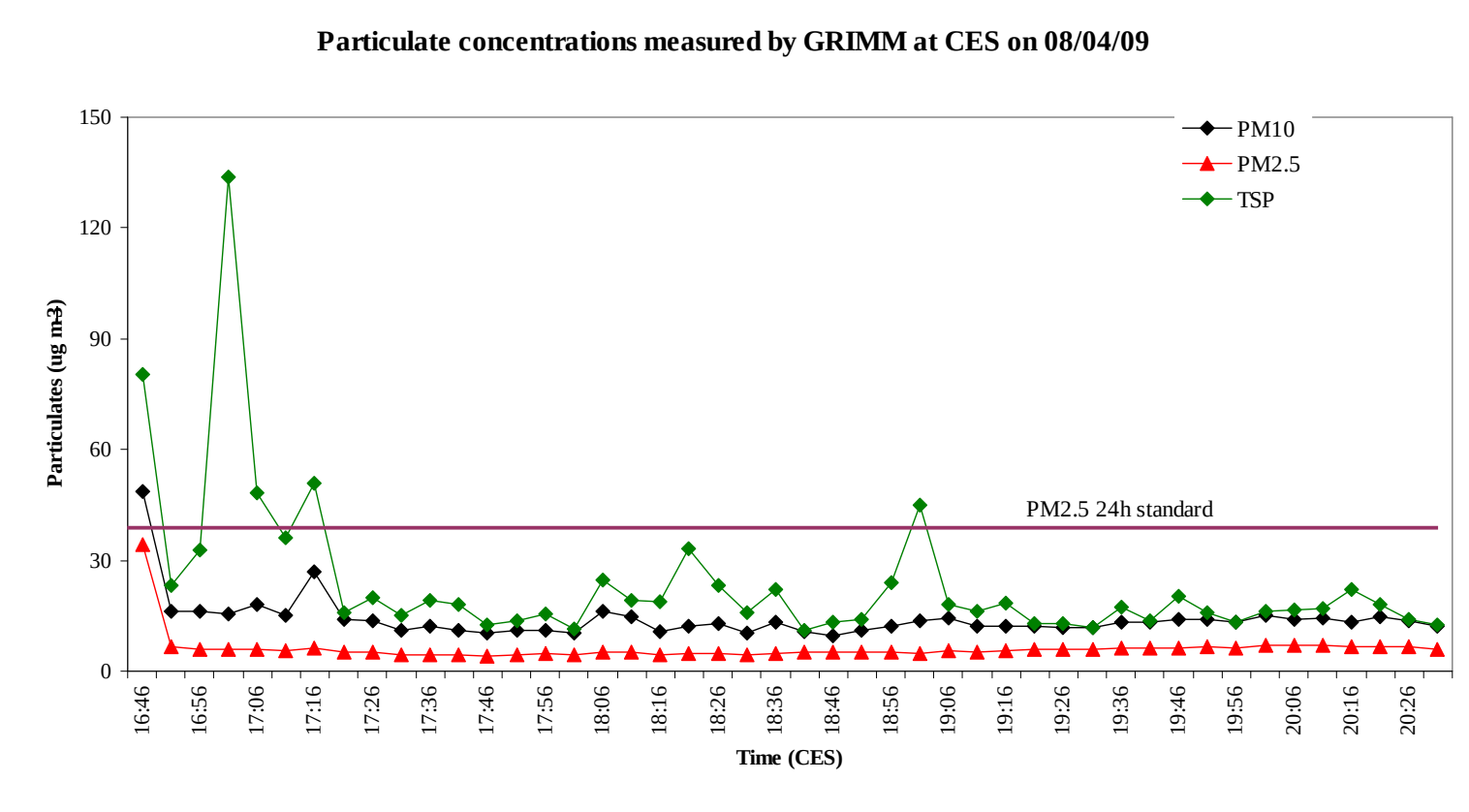
GIS view - MAAML deployment at a local remediation firm

Case Study #1 – Background Information

Still photo from Fox26 Houston

- **Impacted sites within 1000 feet include:**
  - **Daycare & school**
  - **Church**
  - **Numerous residential & commercial properties**
  - **A second school is located 1600 feet from the facility**

Case Study #1 –Rapid Response



- BAQC/MLP notification of fire at facility – 1650 04Aug09 (all times CDT)
- MLP arrival with MAAML on site - 1725 04Aug09
- Start time for MAAML collection of PM data – 1735 04Aug09
- Start time for MAAML collection of VOC data – 1730 04Aug09

Case Study #1 – ISCST3 Modeling of MAAML Data

- Circles denote Scrubber A (bottom) and B (top)
- Car symbols denote Sites A, B, D, and C (top to bottom)

North

Table 1: Estimated maximum emission rates from scrubbers (lb/hr)

		Stack A	Stack B	Area emission
6/18/08~6/20/08	Benzene	0.93	0.15	0.67
(Site A)	Styrene	1.94	0.31	1.41
	VOC	17.61	2.84	12.74
6/21/08	Benzene	9.2*	301.4*	35.9*
(Site C)	Styrene	239.4*	7,816.4*	930.7*
	VOC	865.9*	28269.2*	3365.8*
6/31/08~7/1/08	Benzene	0.03	0.84	0.13
(Site D)	Styrene	0.07	1.93	0.29
	VOC	0.63	17.67	2.61

* Only two ambient samples analyzed

ISCST3 modeling of MAAML data showing elevated estimated maximum emissions rates for benzene, styrene, and VOCs

Case Study #1 - PID Data Plots

North

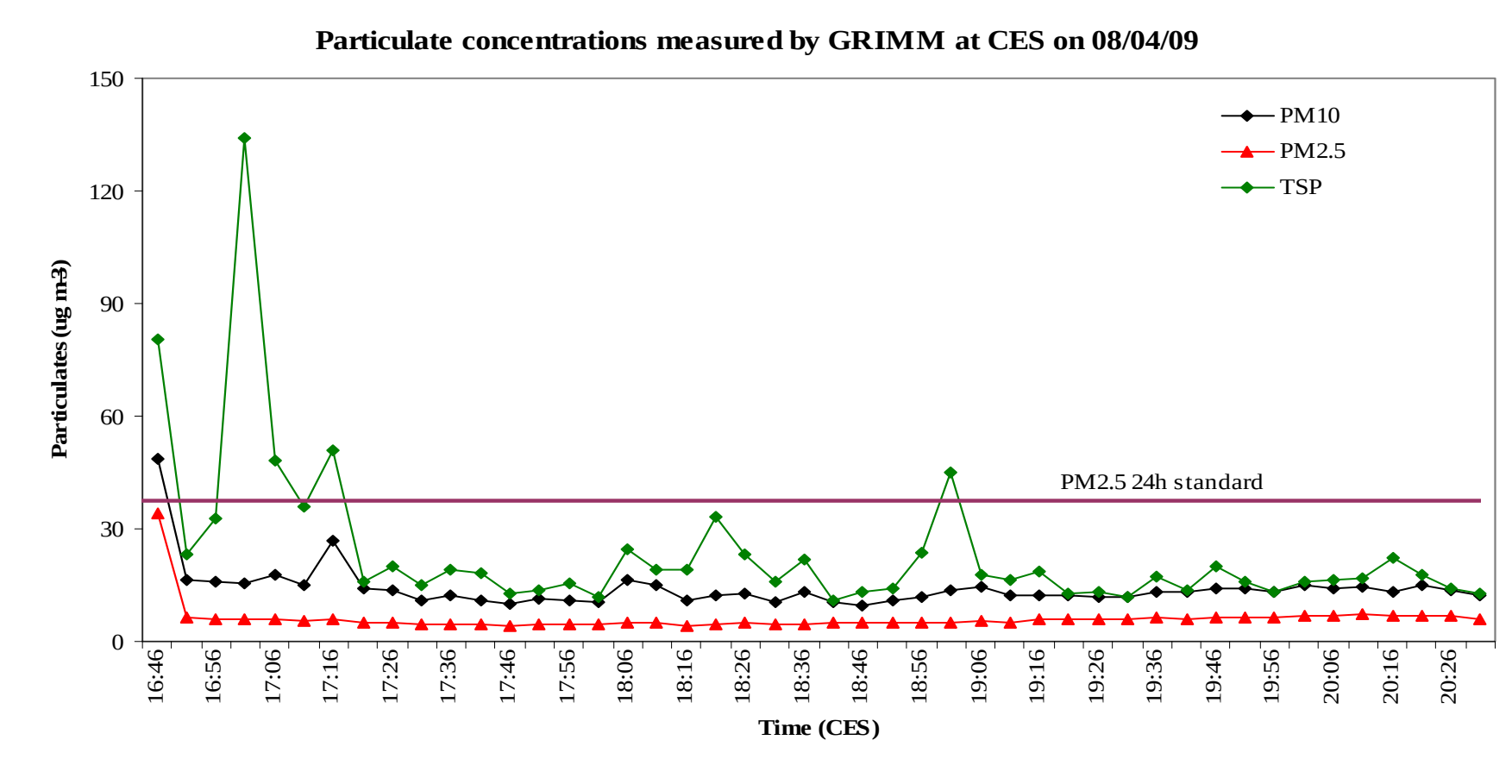
Yellow 500 -999 ppb
Red >1000 ppb

Case Study #1 – IR/Video Stills (Site Survey)

IR Camera

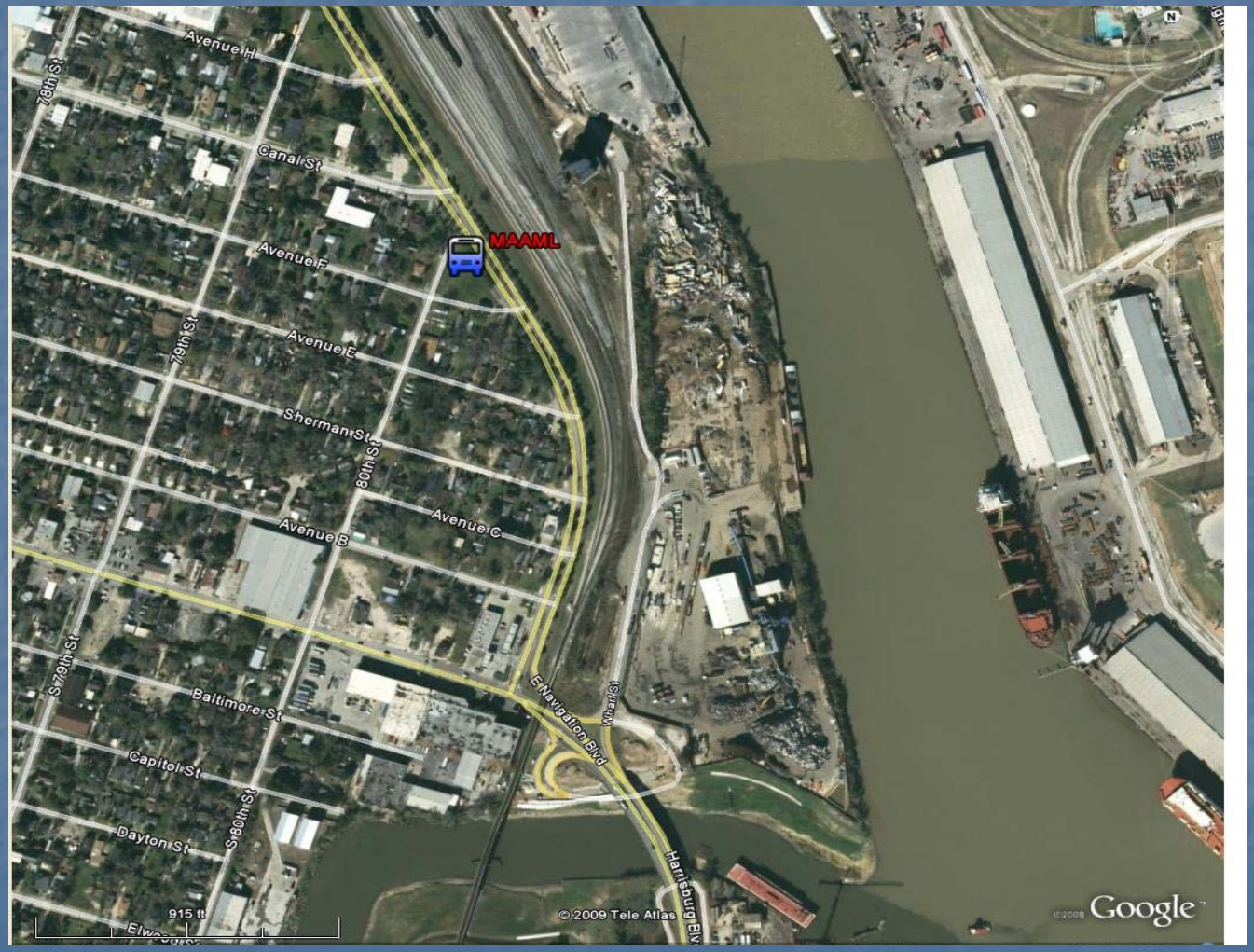
Normal Camera

Case Study #1 – Particulate Matter Data



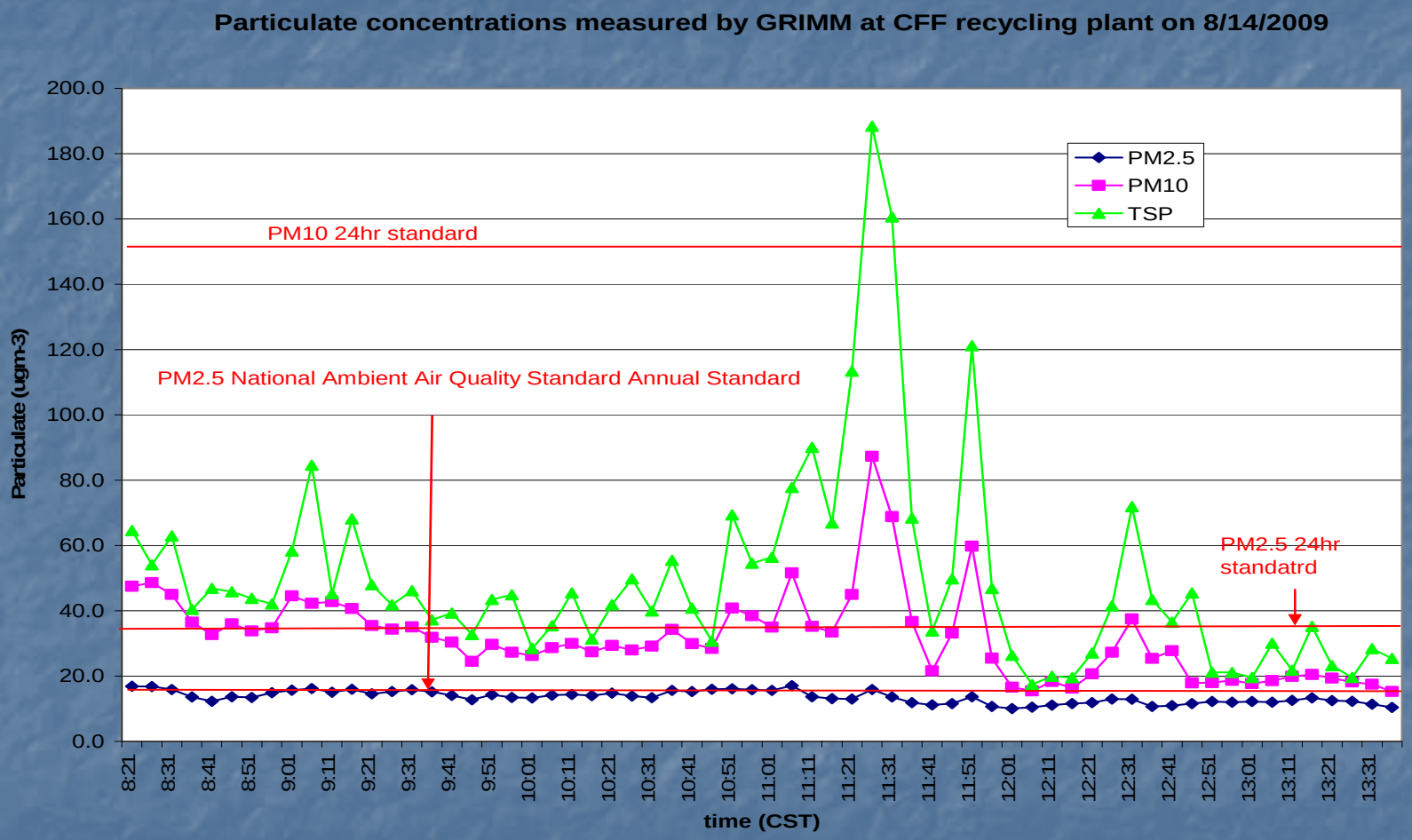
PM concentrations at fence line relative to PM standards

Case Study #2 – Response to Citizen Complaints



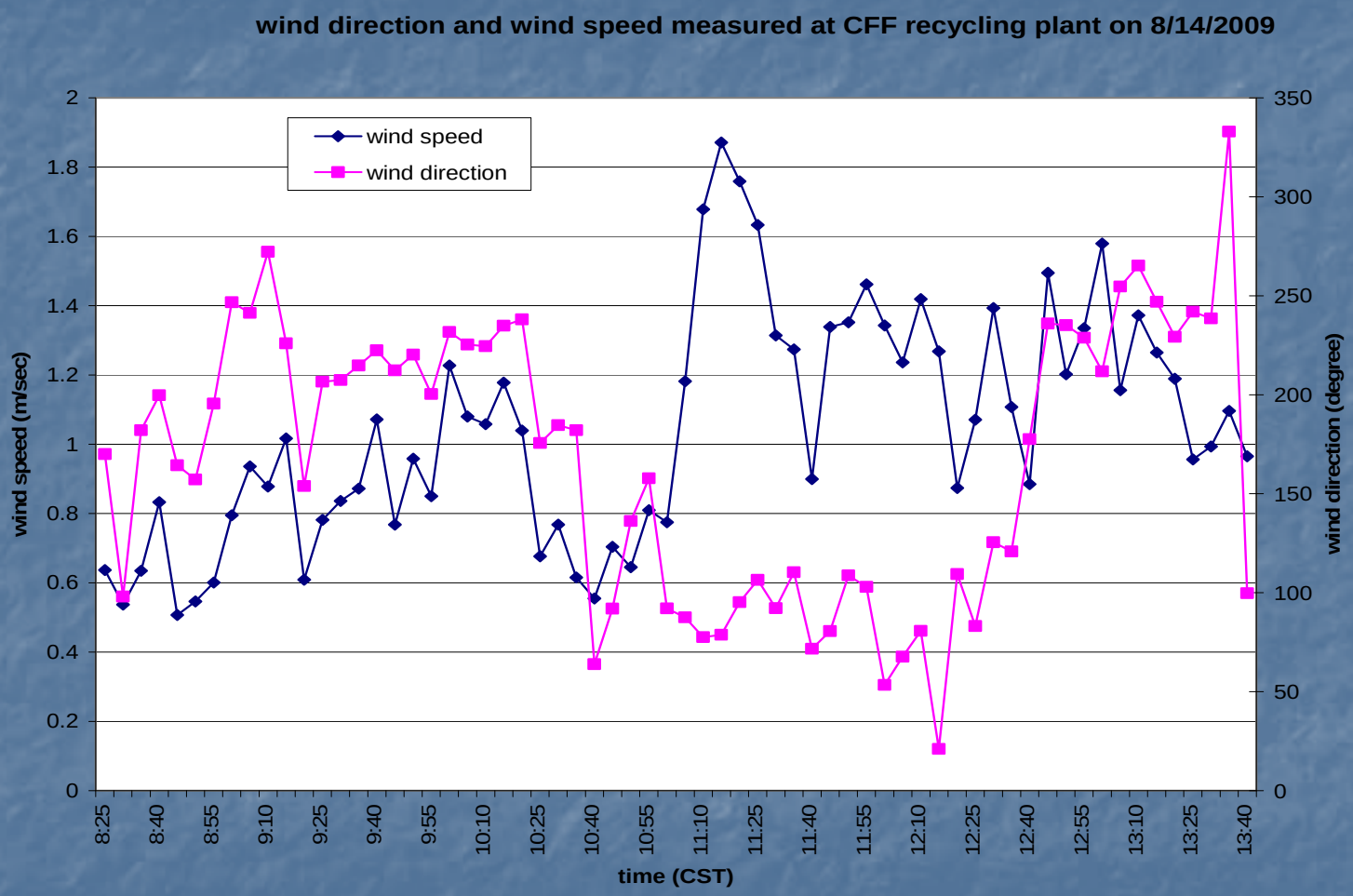
GIS view of MAAML deployment at local scrap metal recycling firm

Case Study #2 – Response to Citizen Complaints



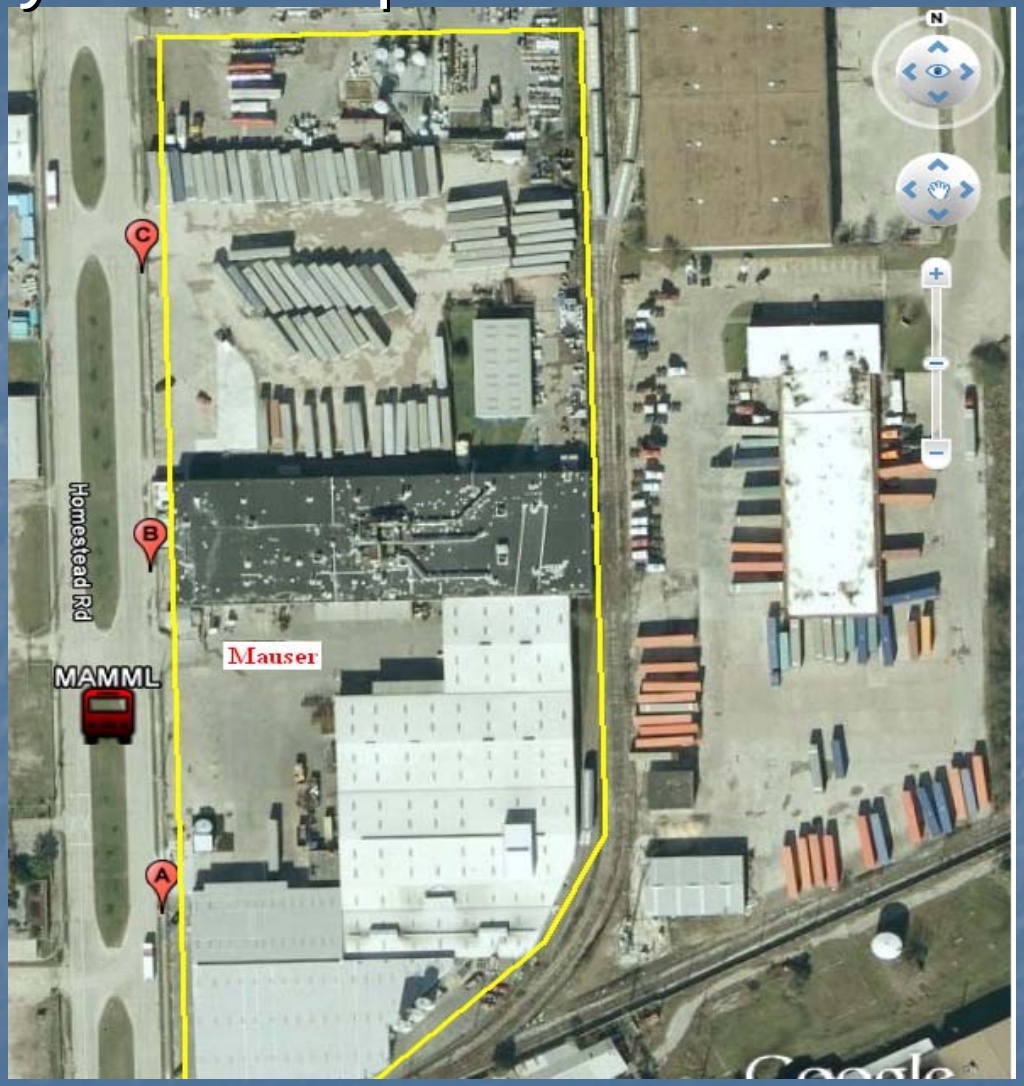
PM concentrations at recycling firm relative to PM standards

Case Study #2 – Response to Citizen Complaints



Wind speed and direction data during monitoring event

Case Study #3 – Response to Citizen Complaints



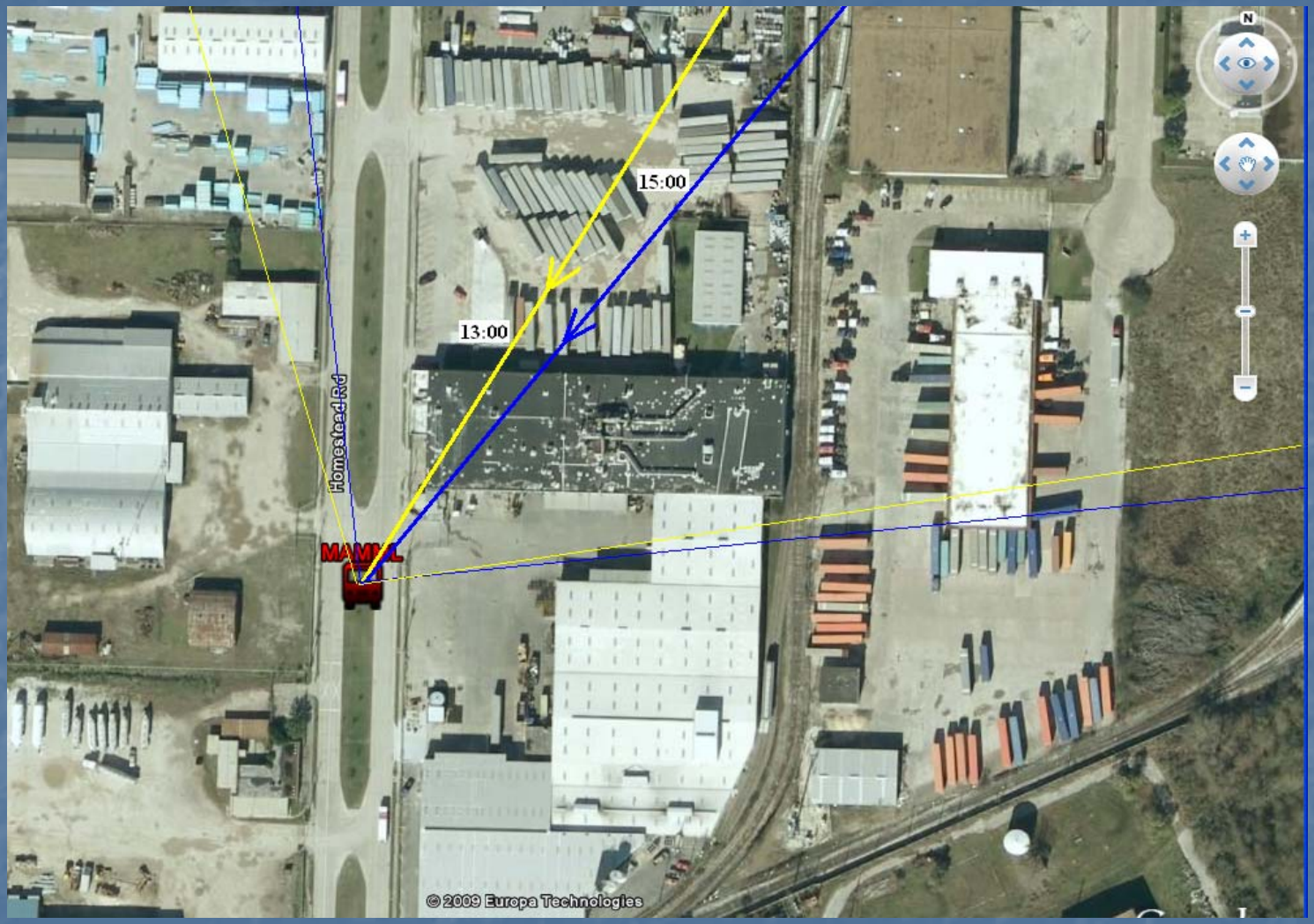
MAAML deployment site and PID monitoring points at a local storage drum plant

Case Study #3 – Response to Citizen Complaints

Time (CST)	Sample ID	Hexane	Toluene	m/p-Xylene	o-Xylene
13:00	am09020913	18.6	13.5	8.3	2.3
15:00	am09020915	0.2	12.0	26.8	6.6

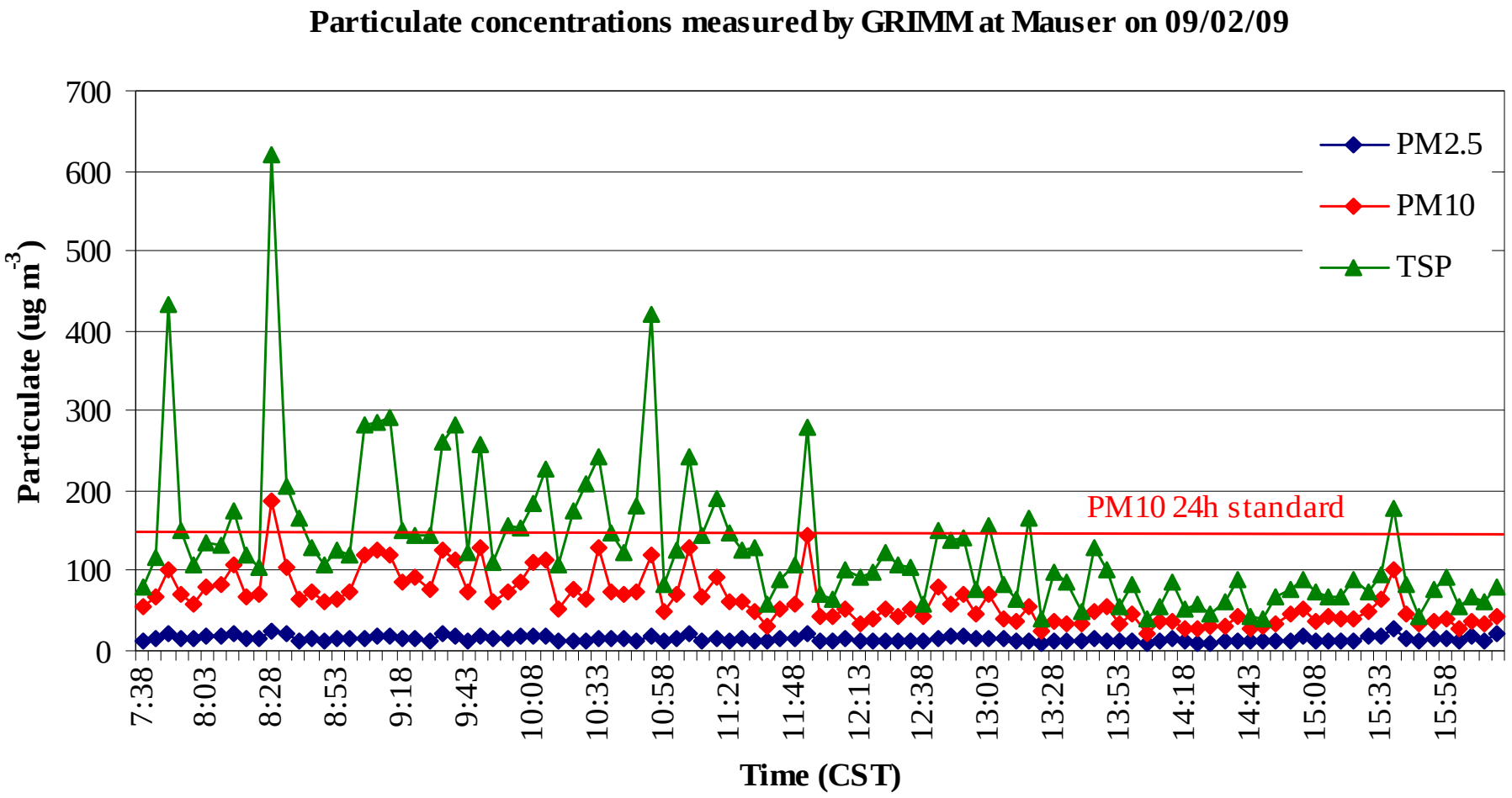
GC/MS data (ppbv) for compounds of interest - MAAML monitoring run

Case Study #3 – Response to Citizen Complaints



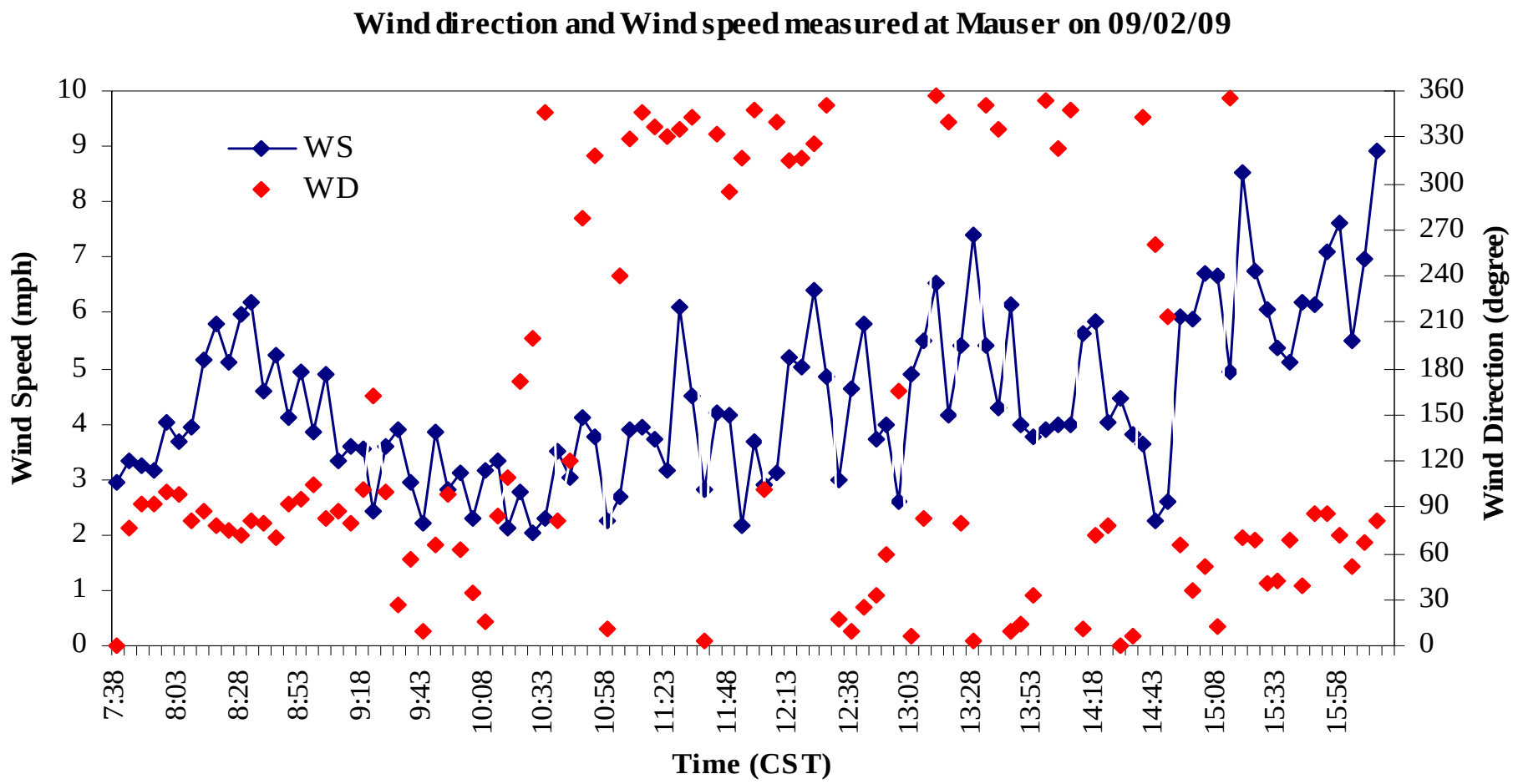
MAAML deployment site and resultant wind directions during monitoring run

Case Study #3 – Response to Citizen Complaints



Graph of PM concentration vs. time - MAAML monitoring run

Case Study #3 – Response to Citizen Complaints



Graph of wind speed and direction vs. time - MAAML monitoring run

Local-Scale Air Monitoring - Conclusions

- The proximity of residential and mixed-use zones to industrial applications from light to heavy necessitates an action plan for local-scale monitoring
  - Local-scale air monitoring can provide a more rapid response to unplanned emissions events in support of air quality issues
  - Citizen complaints help “drive the boat” in directing limited resources for monitoring runs
- Successes from local-scale monitoring becomes self-perpetuating
  - Accomplishments showcase impact of the team approach in resource allocation
  - Achievements can also bring about new ventures and opportunities to add value to existing air quality improvement efforts

The Future of Local-Scale Monitoring – BAQC

- An recent agreement between the City of Houston and the County Attorney's Office for Harris County allows for expansion of the MAAML's local-scale monitoring
  - More Bureau resources can assist in addressing air quality problems outside City limits that impact Houston residents
  - Recognition of Bureau successes including numerous MAAML monitoring runs emphasizes the value other agencies have seen in the City's approach to air quality issues
- The Bureau's incorporation of the MAAML as a vehicle for enhancing the investigation of CAA violations and citizen complaints reflects what the MAAML can provide in the area of local-scale air monitoring.

Acknowledgements

- U.S. EPA, Region 6
- U.S. EPA
- Texas Commission on Environmental Quality
- Houston Endowment, Inc.
- Houston Advanced Research Center (HARC)
- Providence Engineering, LLP
- Quantum Analytics
- Agilent Technologies
- Met One Instruments, Inc.
- Stephen Williams, M.Ed., M.P.A. – Director HDHHS
- Arturo Blanco, M.P.A. – Chief, BAQC

MLP Personnel Contacts

Dr. Wei-Yeong Wang: wy.wang@cityofhouston.net

James Rhubottom: james.rhubottom@cityofhouston.net

Dr. Youjun Qin – youjun.qin@cityofhouston.net

Dr. Peter Chen – peter.chen@cityofhouston.net

Questions?