An aerial photograph of Buffalo, New York, showing a dense urban landscape with various buildings and a prominent highway interchange. The sky is hazy, suggesting a high concentration of fine particles. The text is overlaid on this image.

# Spatial distribution of ultrafine particles on Buffalo's West Side

Monty R. Littlejohn, CC II

Jamson Lwebuga-Mukasa, M.D., Ph.D.

Center for Asthma and Environmental Exposure

# Peace Bridge Complex

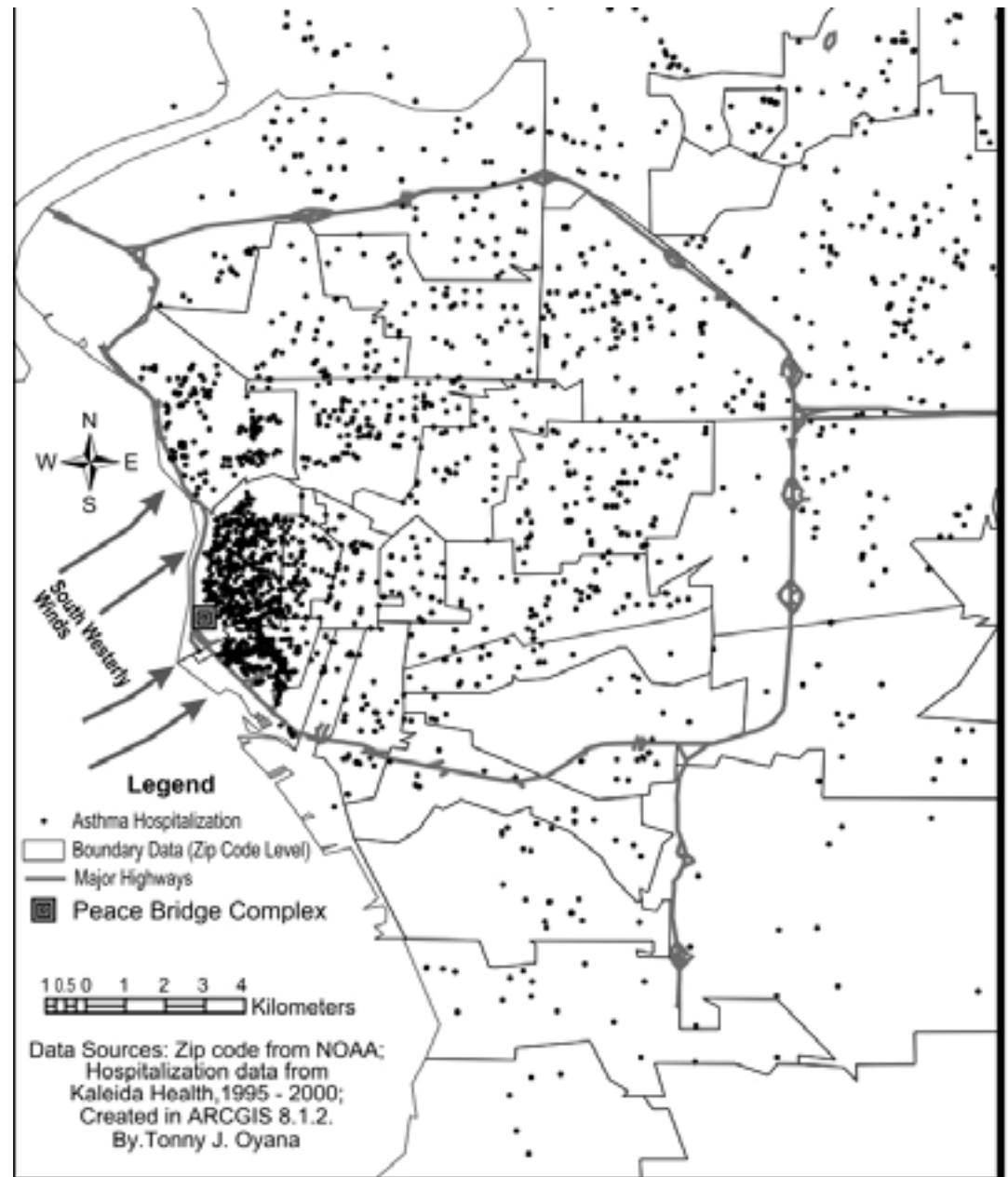
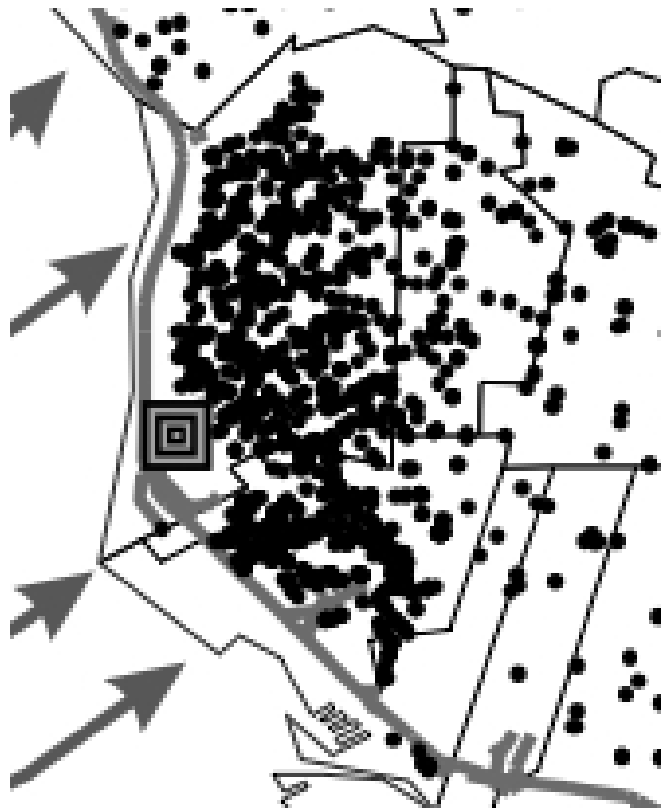


# Study Question



What is the distribution pattern of ultrafine particles at a community level?

## Study Area: high asthma rates



# Methods

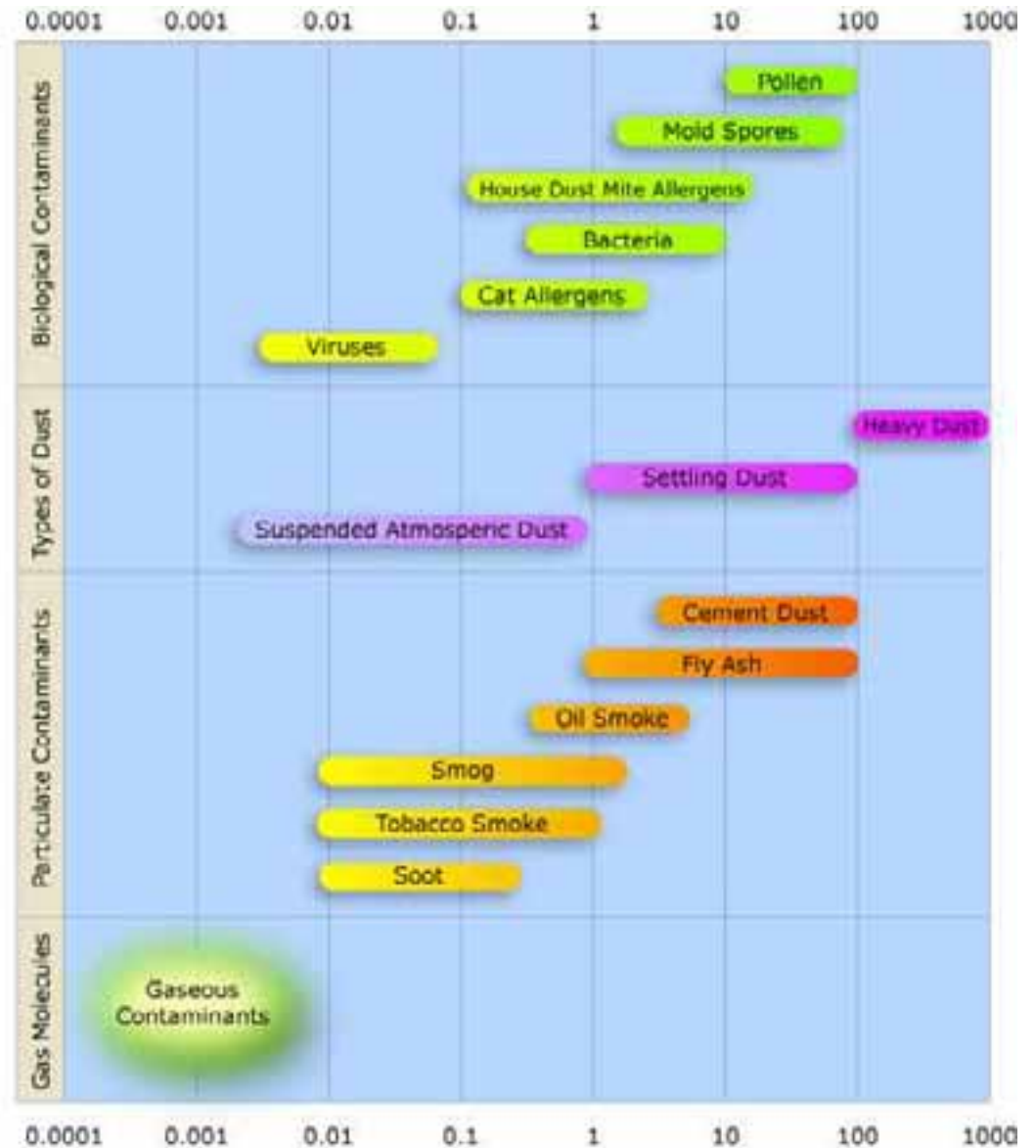
- Data Collection
  - 1 week campaign (2006) → extended to 2 weeks (2007)
  - 2x/d measurement ‘runs’
    - 8am-12pm
    - 3pm-7pm
  - All equipment was factory calibrated before study
    - measure particle counts (P-Trak 8525)
    - GPS location (Meridian Gold)
    - meteorological data ([www.noaa.org/GLC](http://www.noaa.org/GLC) marine station)
    - traffic data ([www.peacebridge.com](http://www.peacebridge.com))
  - Descriptive observations (traffic congestion, construction, etc...)
- Data analysis/cleaning
  - Software



# PM $<0.1$

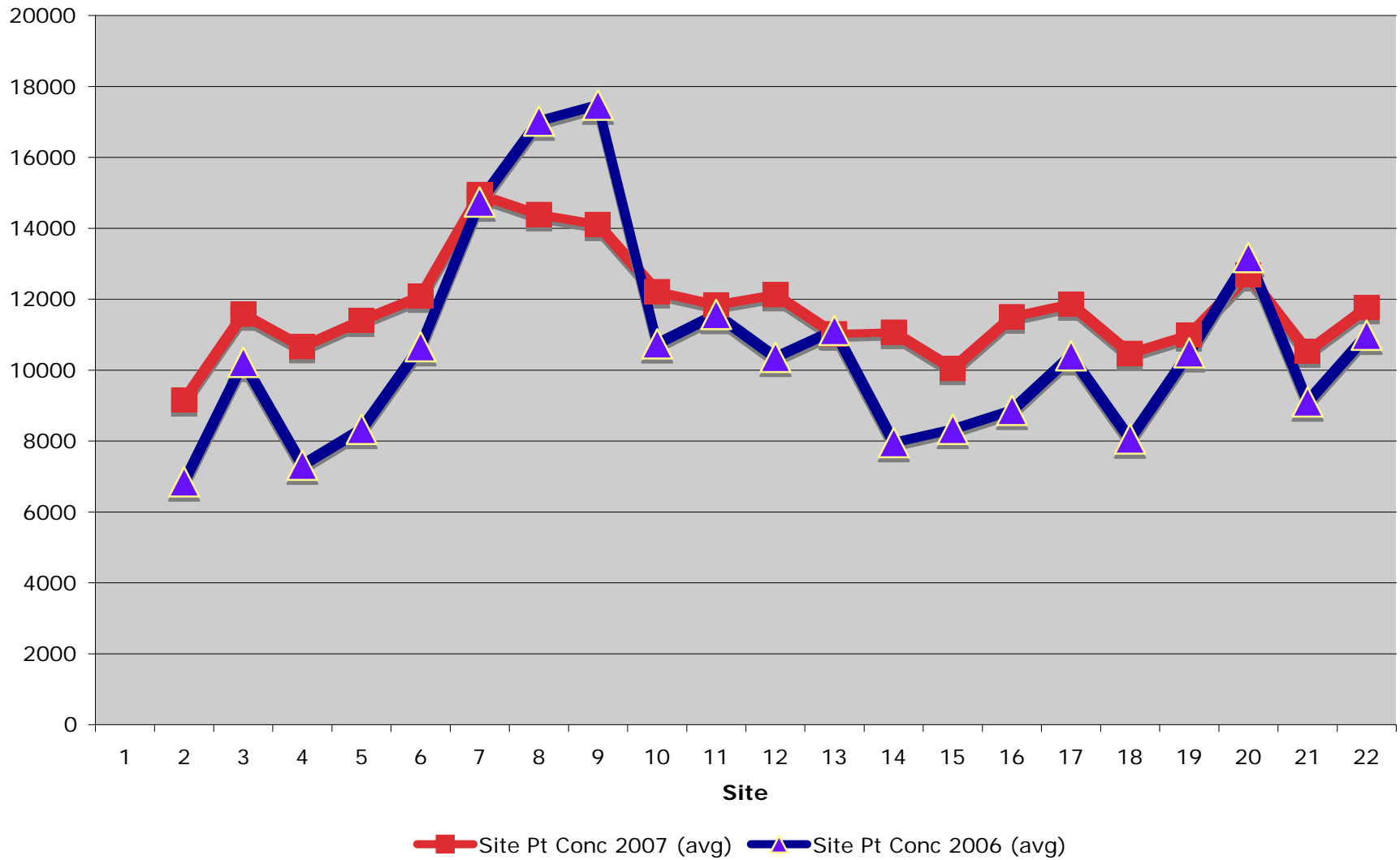
## Why measure UFP?

- Short lived particles
- Representative of mobile pollution sources
- Condense/coagulate
- Carry heavy metals/other pollutants

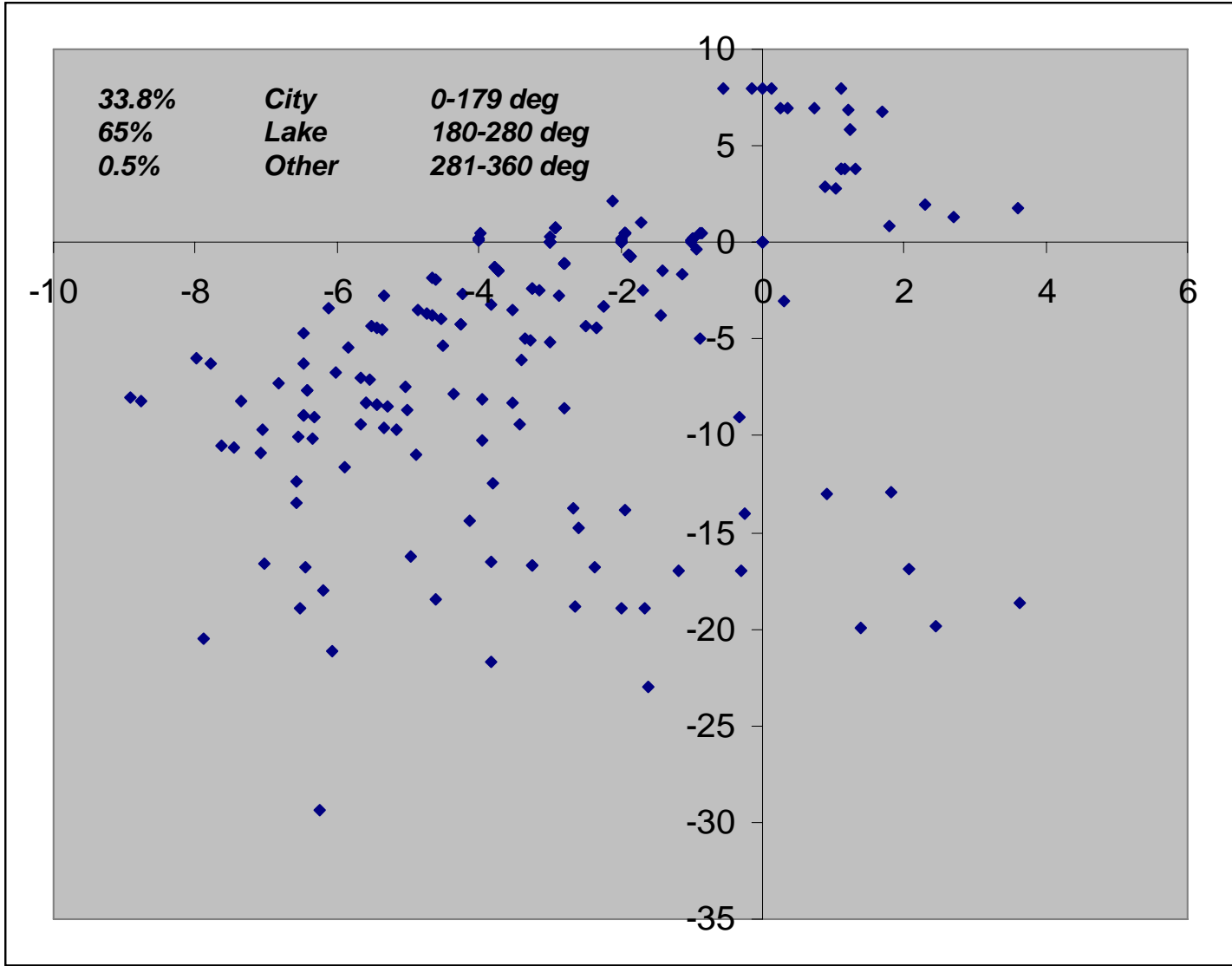


# Results

UFP count (site avg)



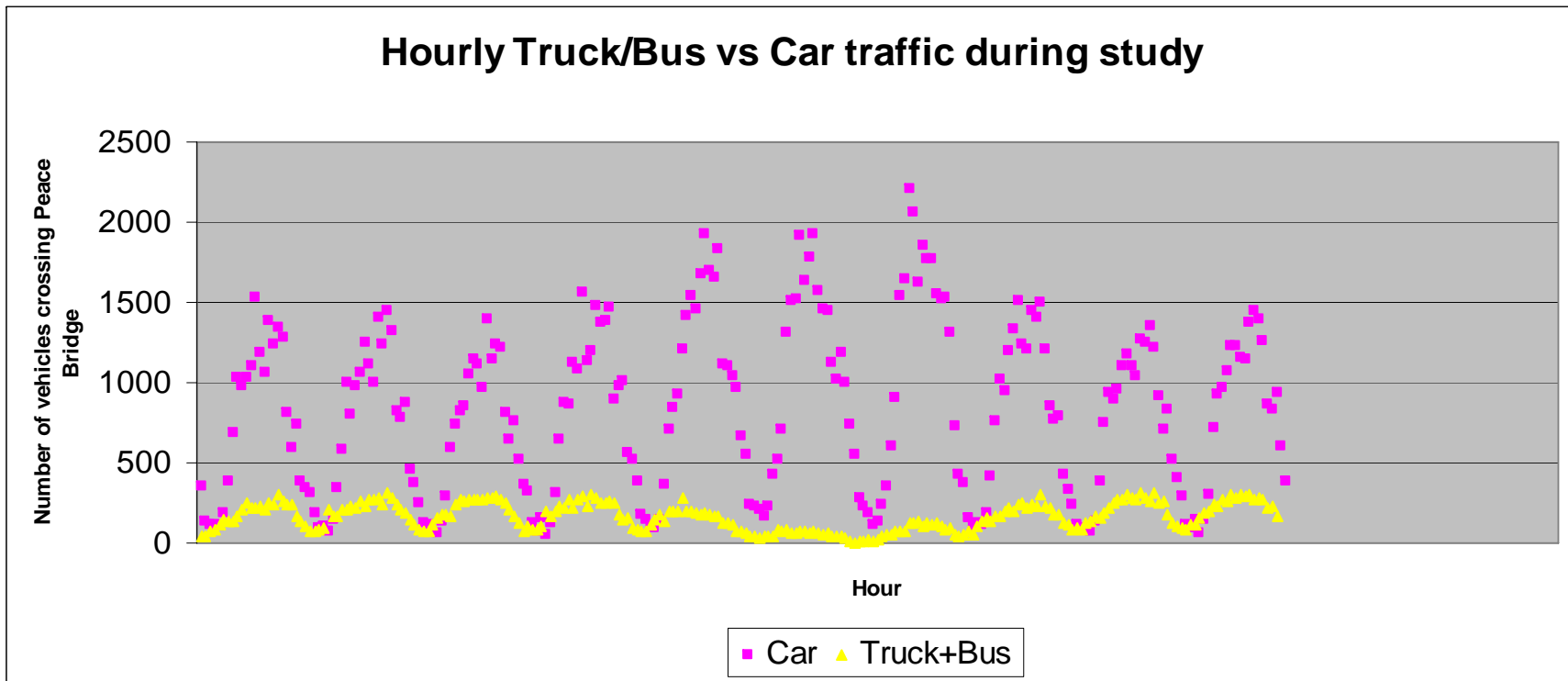
# Wind Rose (2006)



Lake winds – from SW  
City Winds – from E  
Other wind – from NW

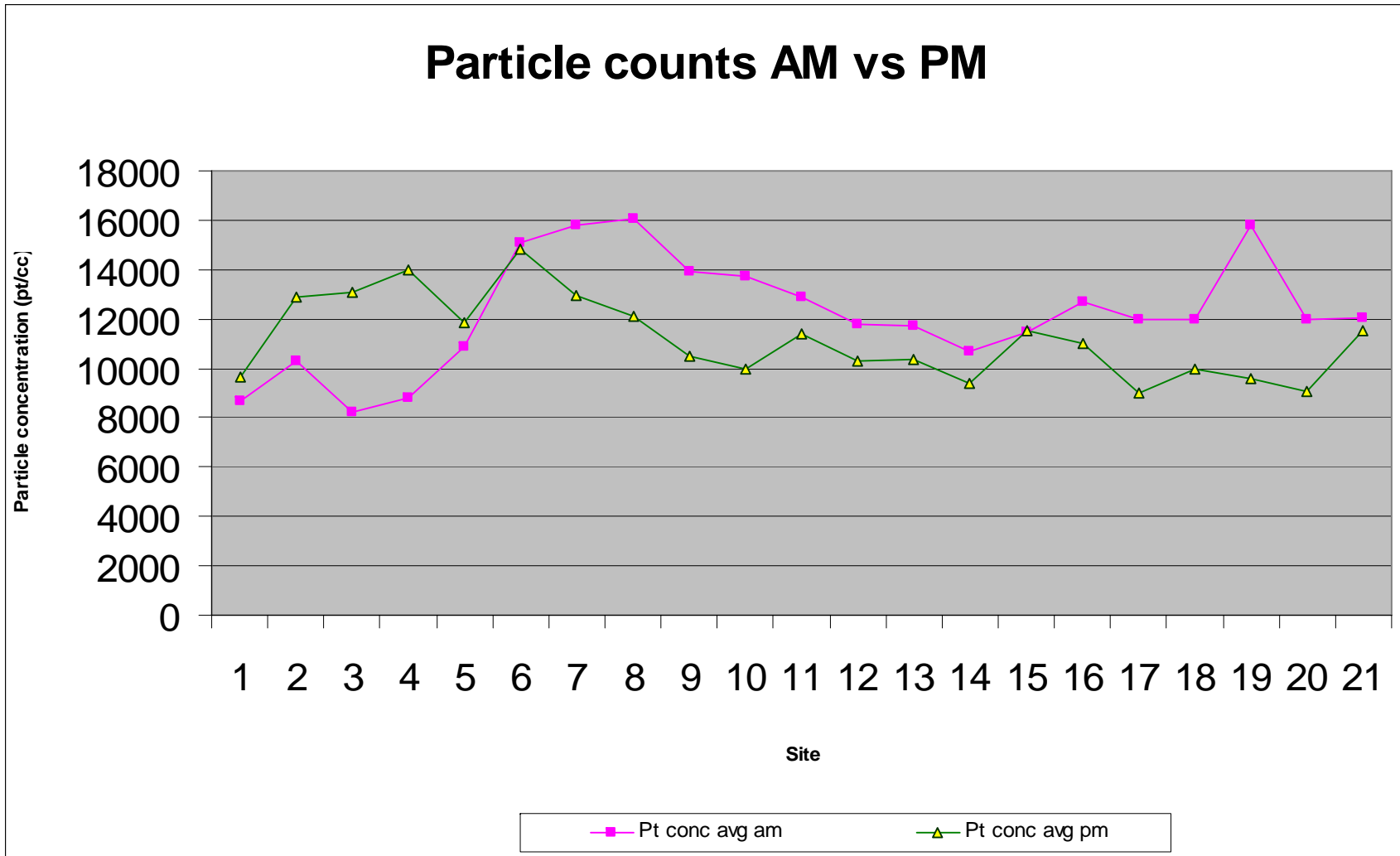


# Traffic patterns - hourly



# AM vs PM (2007)

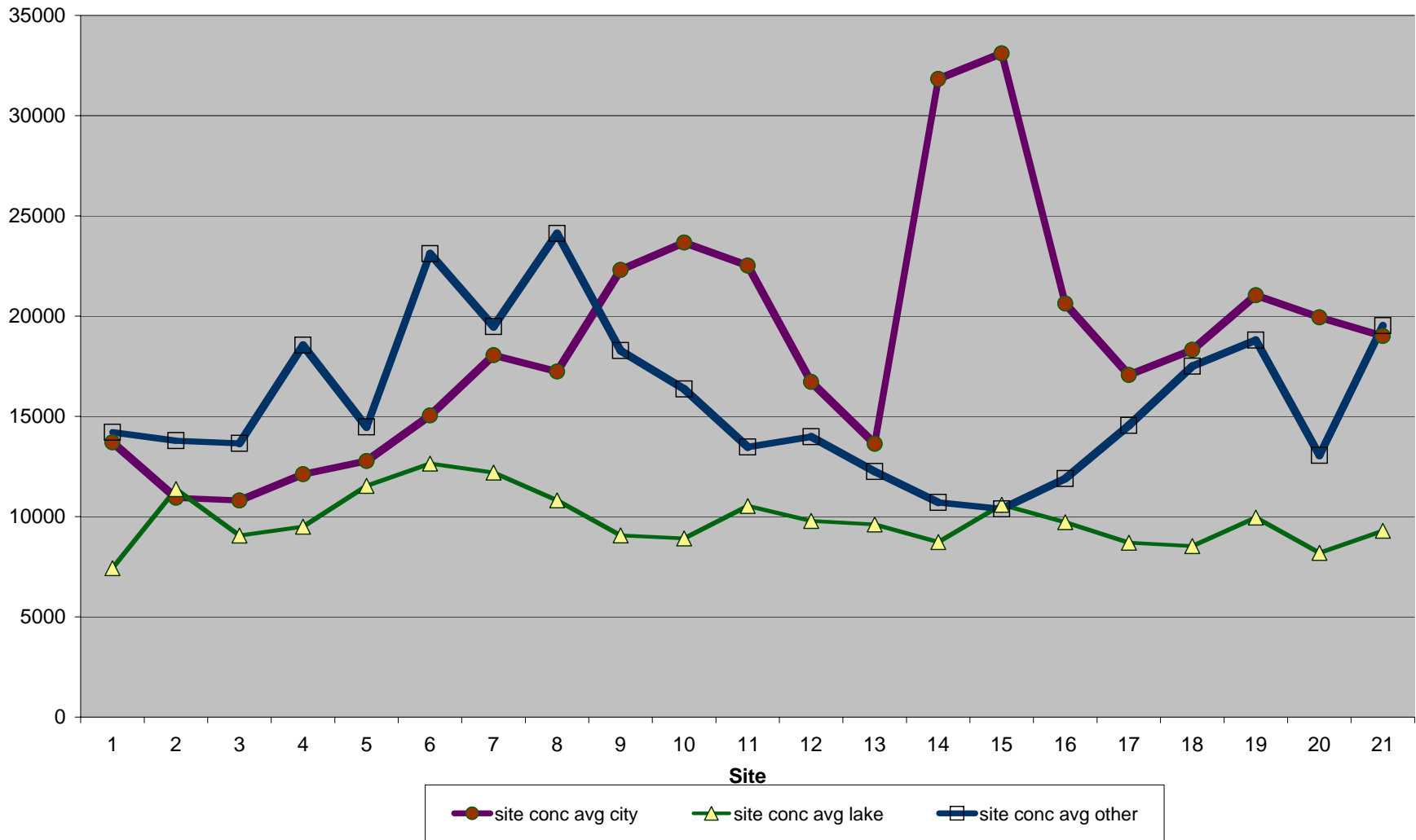
- N vs S traffic on I-190





# PM $<_{0.1}$ data (2007)

Particle concentration vs city\_lake\_other wind





John Hickey/Buffalo News

Traffic has been heavier but moving uninterrupted — and for free — during rush hour as the Breckenridge Street toll barrier comes down.

# Traffic surge follows toll removal

## *More vehicles use Niagara, Mainline Thruway*

By JOHN F. BONFATTI

NEWS STAFF REPORTER

The elimination of toll barriers at Breckenridge and South Ogden streets has led to significant increases

two months after the Thruway Authority bowed to public pressure and stopped collecting tolls at the barriers on Oct. 30.

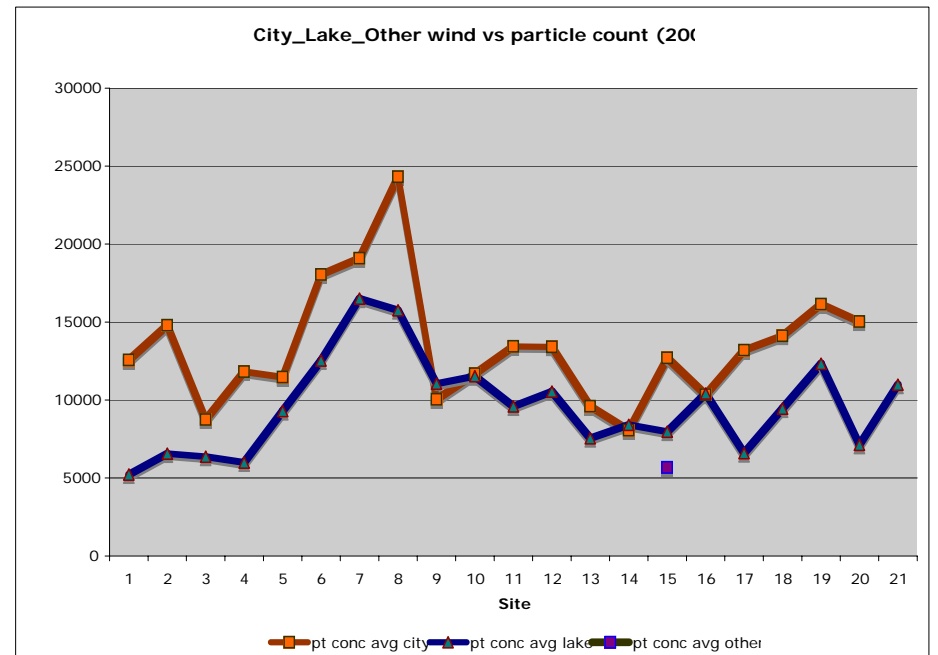
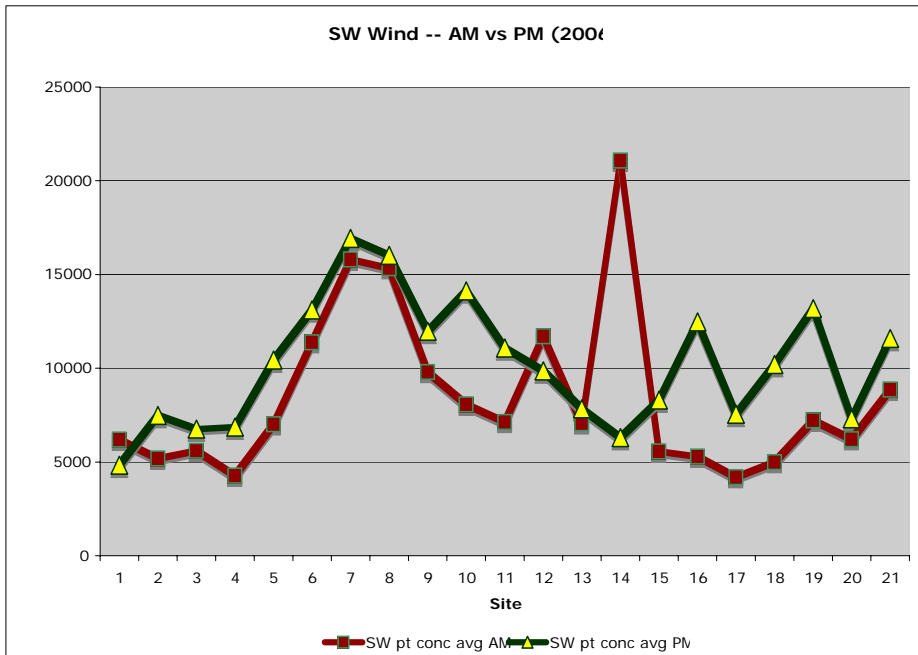
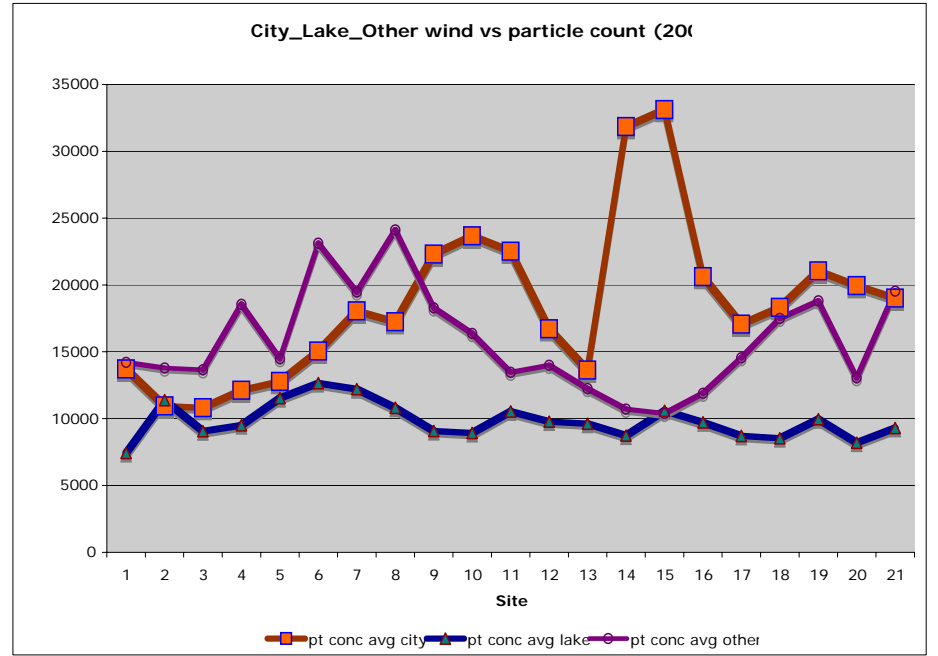
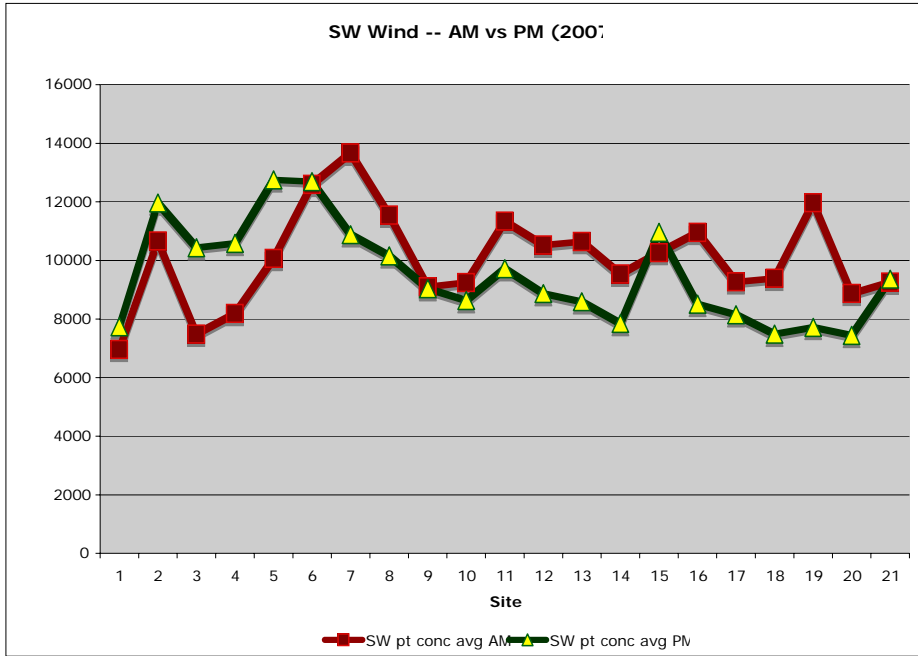
• During the weekday afternoon rush hour, defined as 3 to 6 p.m., traf-

passing the site of the Breckenridge barrier undoubtedly belonged to Dr. Douglas Schultz, a pediatrician who lives on the West Side but commutes every day to Wheatfield.

To return home, he used to drive south on the Niagara Thruway, get off at the Scajaquada Expressway exit to avoid paying the Black Rock toll, then

Traffic at all other interchanges was up, as it was along the Mainline Thruway from the Lackawanna toll barrier to the interchange with the Youngmann Highway.

The biggest increases were found at the locations of the former toll barriers and from the interchange of the Niagara Thruway with the Thruway to



# Summary

- The predominant wind direction (SW), showed a rise in particle counts compared to upwind, and a dropoff to background levels
- When winds came from the city and other directions, there were other hotspots (mobile or fixed sources)
- Pt cc are high at various sites compared to upwind readings, which suggests that urban residents are exposed to levels adjacent to the I-190 (~20,000 pt cc)
- This study confirms the findings of other studies (HEI, CAEE)

# Strengths and Limitations

- Strengths
  - Large area of study
  - Reliable and accurate instruments
  - Expansion revealed other sources which contributed increased particle counts
- Limitations
  - May undercount newly formed particles (20-100nm only with P-Trak)
  - Unknown chemical composition



# Conclusions

- **This large area of study indicates increased levels of ambient UFP (PM<sub><0.1</sub>) in the community**
- **Traffic pattern changes may be related to increased particulate counts**
- **Relationships between increased UFP (PM<sub><0.1</sub>) and chronic lung disease remains to be determined (known role in inflammation)**

# Future Study Direction

- Topographical map of [UFP] showing hotspots
- Statistical modeling to predict pt cc given traffic patterns, meteorological data and GPS location
- Characterization of chemical composition of particulates ( $PM_{<0.1}$ )



Thank you!

