Urban Community Air Toxics Monitoring Project, Paterson City, NJ

UCAMPP

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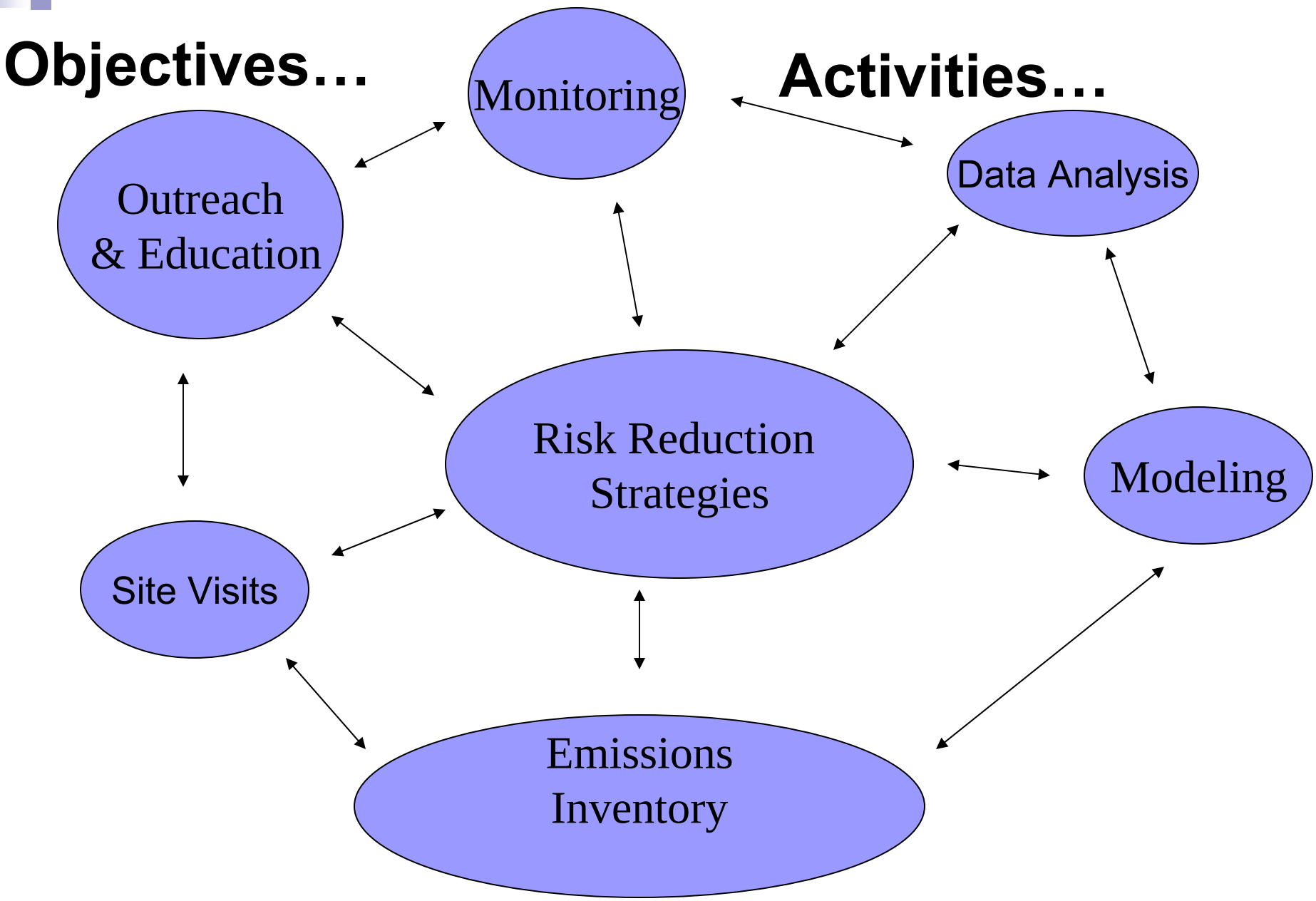
10/07

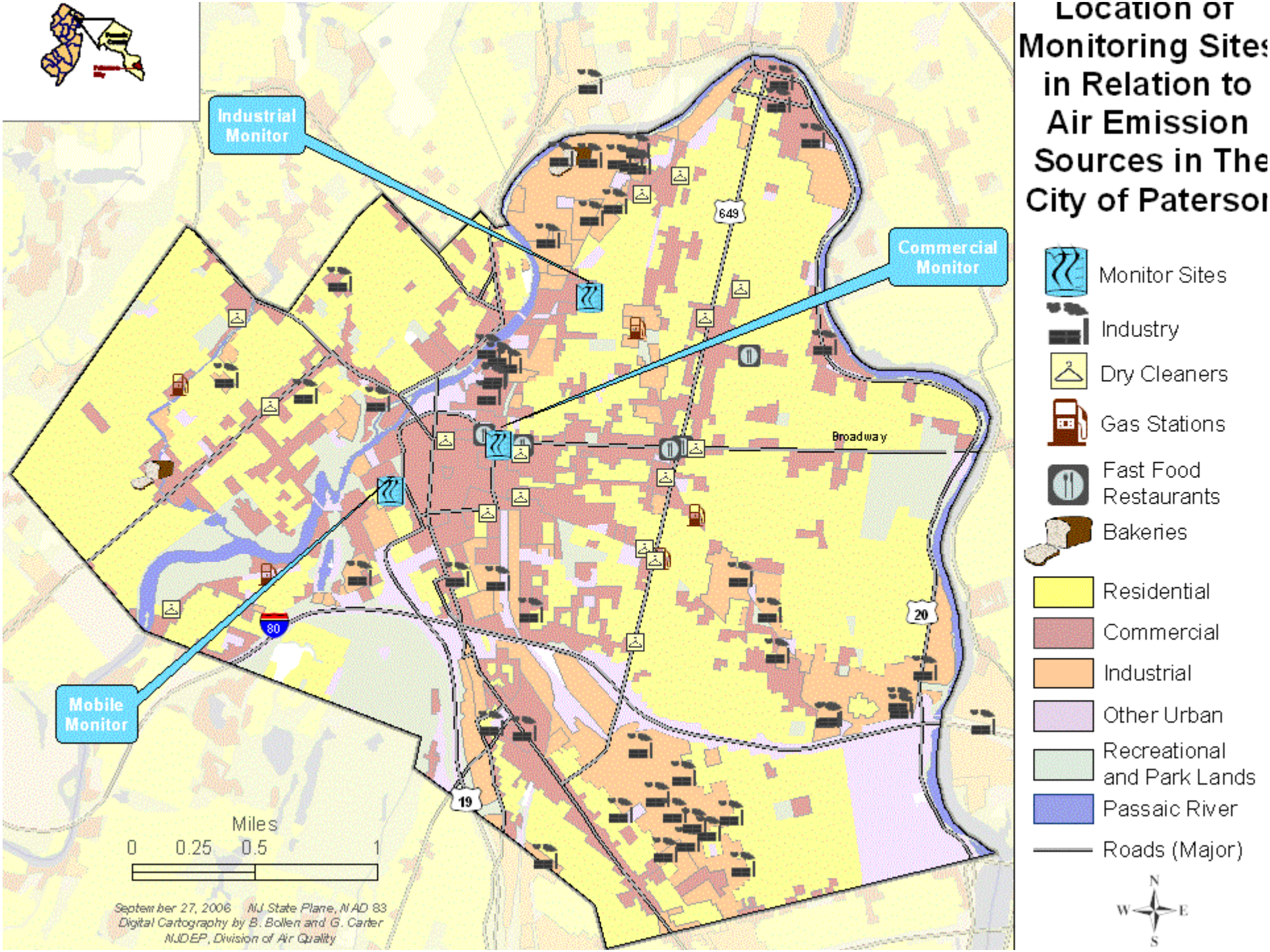
Purpose

UCAMPP should really have been called Identification of Risk Reduction Strategies for Air Toxics in an Urban Community Through Emissions Inventory, Site Visits, Outreach & Education, Modeling, & Monitoring.


Objectives…
Monitoring
Activities…
Outreach & Education
Data Analysis
Risk Reduction Strategies
Modeling
Site Visits
Emissions Inventory

Rationale


12th Ave
SCHOOL BUS


Location of Monitoring Sites in Relation to Air Emission Sources in The City of Paterson
Industrial Monitor
Commercial Monitor
Mobile Monitor
649
Broadway
80
20
19
Miles
0 0.25 0.5 1
September 27, 2006 NJ State Plane, NAD 83
Digital Cartography by B. Bollen and G. Carter
NJDEP, Division of Air Quality
Monitor Sites
Industry
Dry Cleaners
Gas Stations
Fast Food Restaurants
Bakeries
Residential
Commercial
Industrial
Other Urban
Recreational and Park Lands
Passaic River
Roads (Major)
N
W
E
S

Site Selection was Judgment Based

- Flat Roofs
- Accessibility- stairs
- Power
- Safety/Security for field sampling team and instrumentation
- Proximity to land use types

Industrial

Mobile

Commercial

Background

What Was Measured?

- **60 Volatile Organic Compounds-TO-15**
- **4 Carbonyls-PAKS (DNSH) &@ 1 site DNPH**
- **16 PAHs- EOSHI Method**
- **48 Metals- X-Ray Fluorescence**
- **EC/OC- thermal/optical transmittance carbon analyzer**
- **Hexavalent Chromium-EOHSI method**
- **PM_{10} mass**
- **Wind Speed, Direction, Temperature, Humidity, Precipitation - I site**

Every six days for 1 year starting Nov '05

Quality Control

- Planning, SOPs, QAPP
- Field sampling and laboratory audits
- Blanks and Controls (Spikes)
- Preventive Maintenance / Correction Activities
- External Audits: Field & Laboratory
- Precision: Duplicates & Replicates
- Data Assessments-accuracy, % valid

Data Validation

- Use QC checks & audits to confirm validity
- Compare data within network to confirm
- Data Screening & Statistical Analyses
- Review with Bureau of Air Monitoring and Bureau of Technical Service, Air Quality Evaluation, DSRT QA Project Officer etc.

Sample Retrieval Rates (includes regular, duplicate, field blank, trip blank & control samples)

- PM10/Mass & Elements 94%
- PAHs/OCEC 95%
- Cr(VI) 96%
- Carbonyls 99%
- VOCs 90%

What are we going to do with all this data?

- Map the concentration & spatial resolution of air toxics
- Identify which air toxics are associated with which land use types, i.e., mobile, industrial, commercial
- Assess and field test new sampling and analyses techniques for air toxics that are presently difficult to quantify (e.g., Cr^{+6}, acrolein)

- Evaluate modeling results with the monitoring data
- Characterize concerns of an environmental justice type community

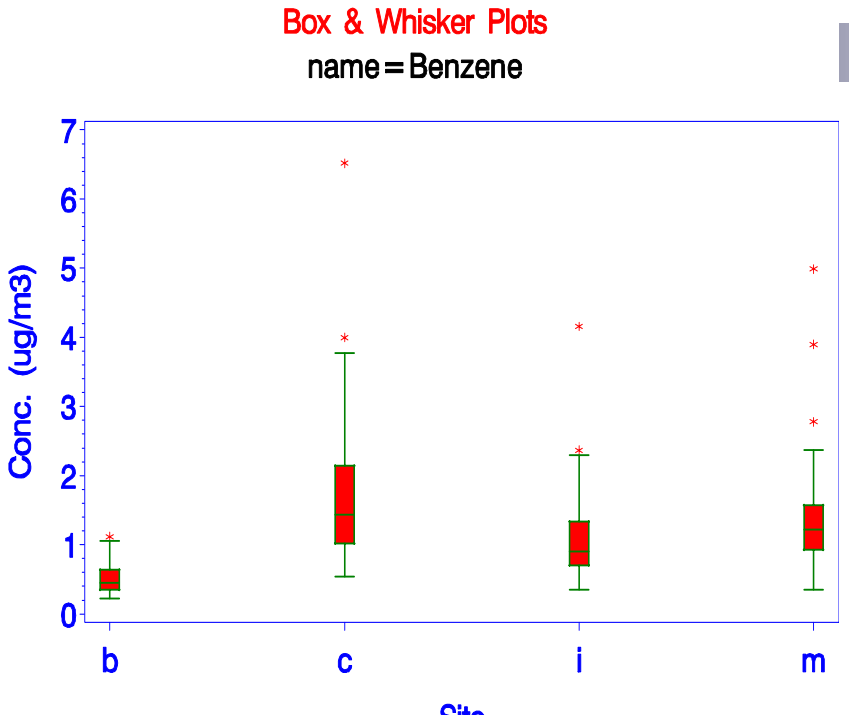
Identify Risk Reduction Strategies

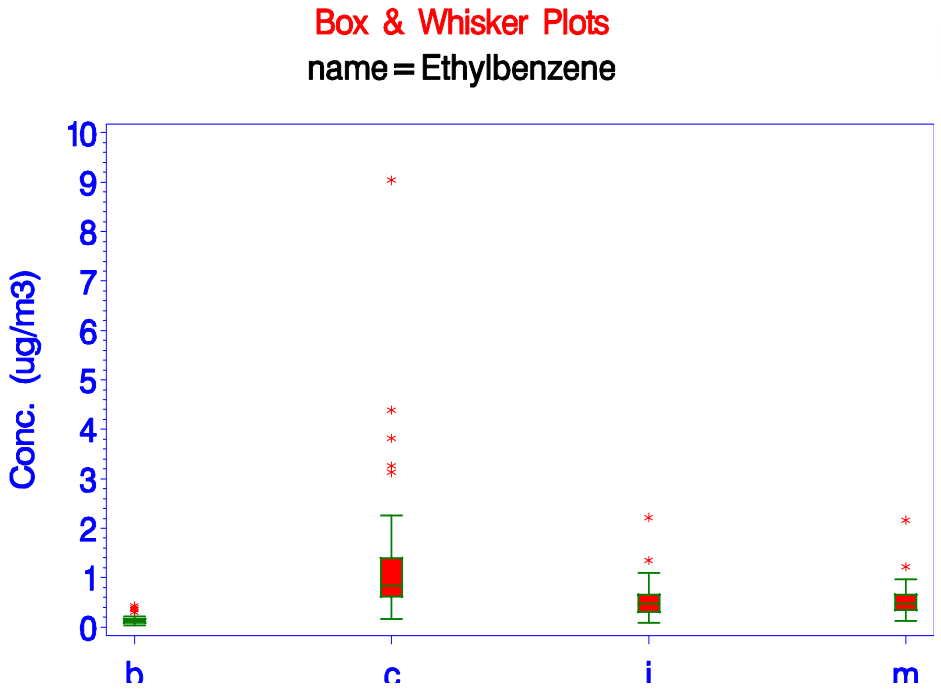
Implement those that we can!

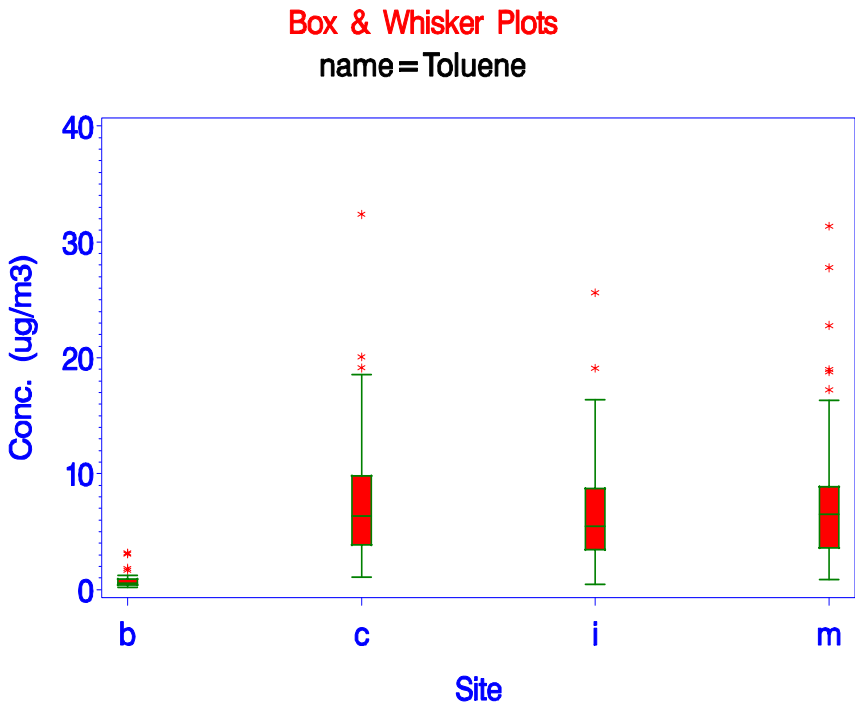
VOCs 100% Nondetected @ All Sites

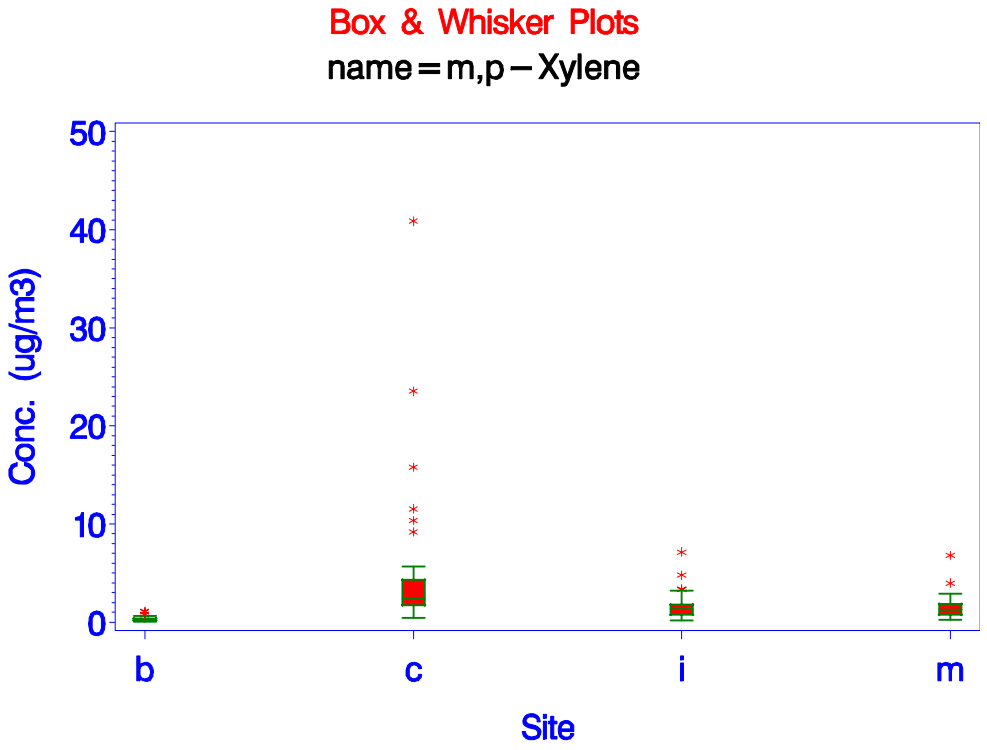
1,1,2 trichloroethane
1,1 dichloroethene
1,2 dibromoethane
1,2 dichloropropane
Bromodichloromethane
Bromoform
Cis 1,3 dichloropropene
Dibromochloromethane
Ethyl tert butyl ether
Trans 1,2 dichloroethylene
1,1,2,2 tetrachloroethane
1,2,4 trichlorobenzene
1,2 dichloroethane
Bromochoromethane
Chloroprene
Ethyl acrylate
Tert amyl methyl ether
Trans 1,3 dichloropropene

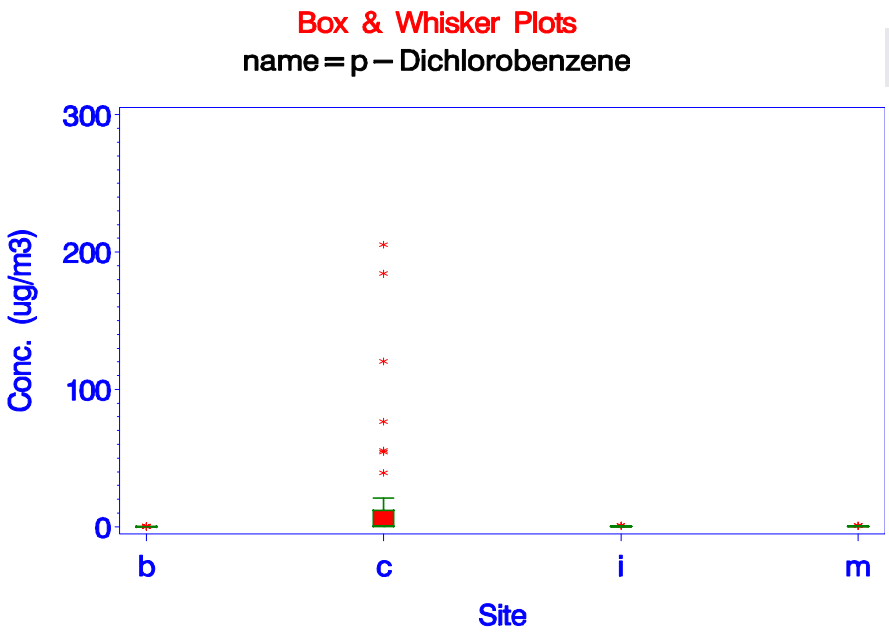
- The BTEX compounds were 100% above the detection level at all Paterson sites and >90% at the Background site.

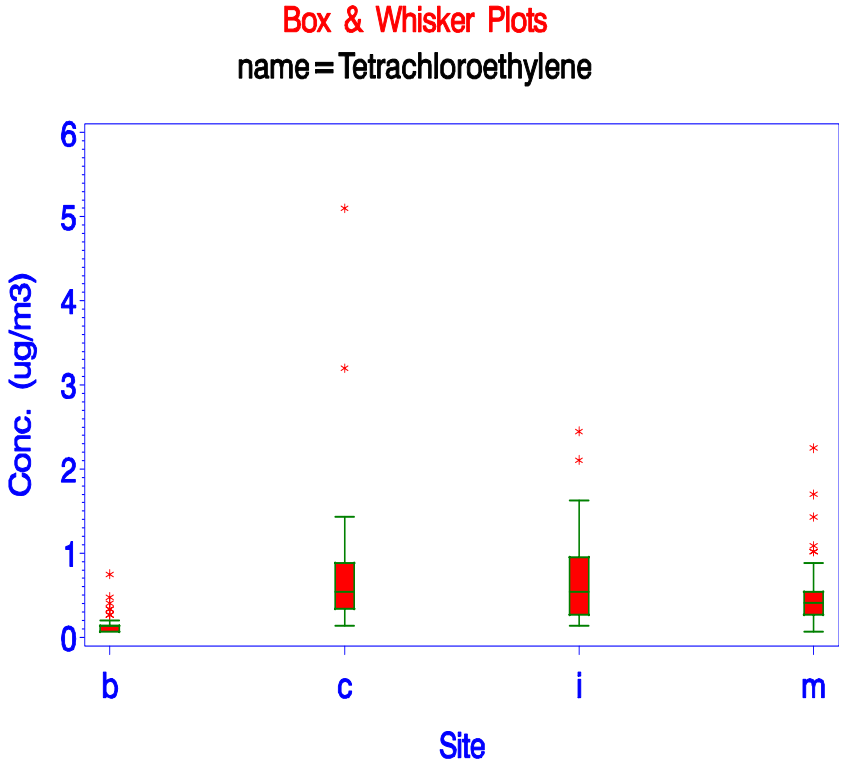

Box & Whisker Plots
name = Benzene
Conc. (ug/m3)
0
1
2
3
4
5
6
7
b
c
i
m

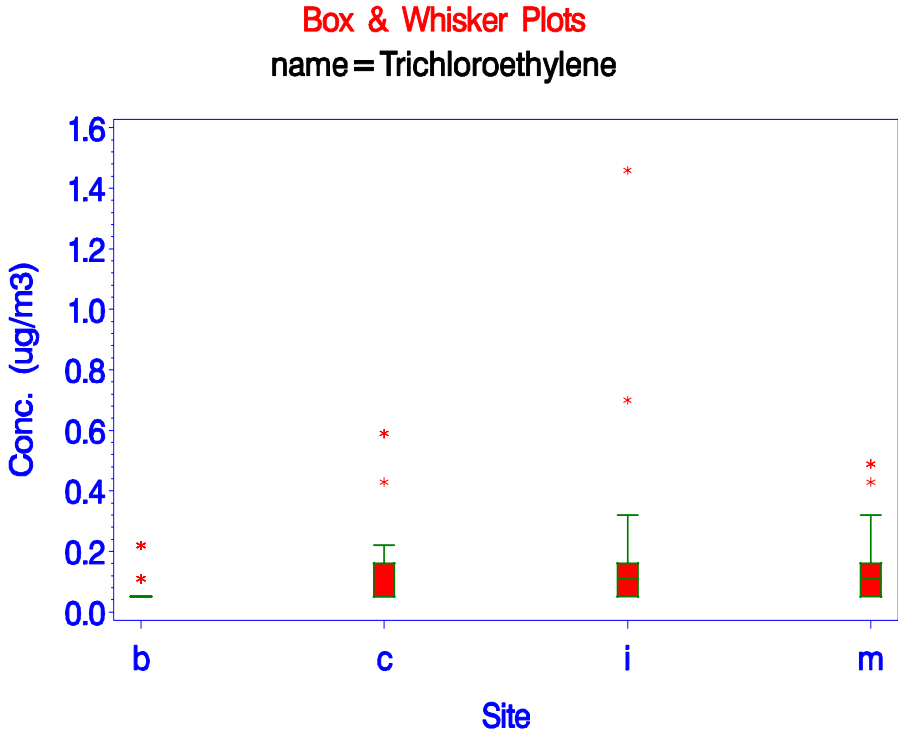

Box & Whisker Plots
name = Ethylbenzene
Conc. (ug/m3)
0
1
2
3
4
5
6
7
8
9
10
b
c
i
m


Box & Whisker Plots
name = Toluene
Conc. (ug/m3)
0
10
20
30
40
b
c
i
m
Site

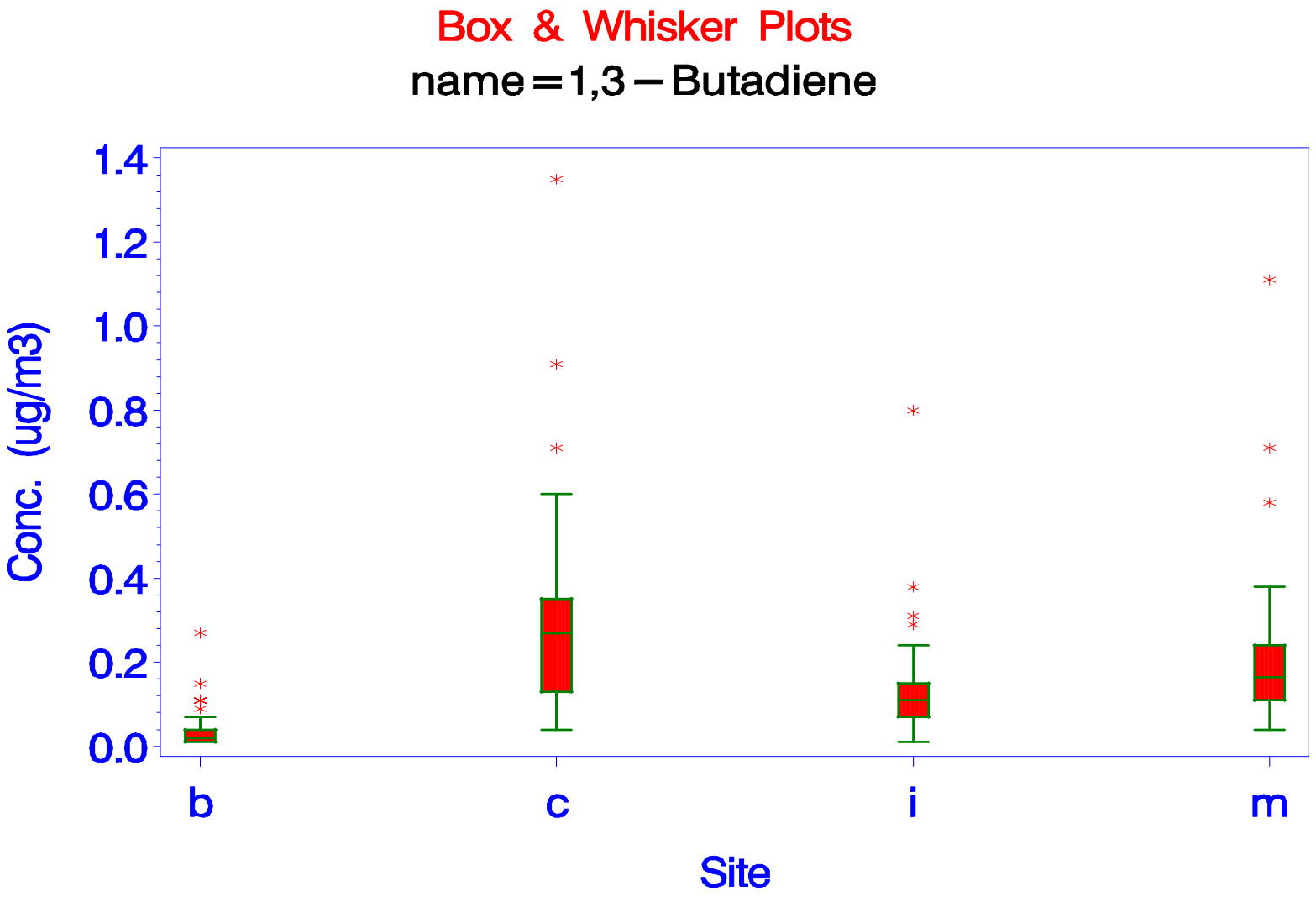

Box & Whisker Plots
name = m,p – Xylene
Conc. (ug/m3)
0
10
20
30
40
50
b
c
i
m
Site


Box & Whisker Plots
name = p – Dichlorobenzene
300
200
100
0
Conc. (ug/m3)
b
c
i
m
Site


Box & Whisker Plots
name = Tetrachloroethylene
6
5
4
3
2
1
0
Conc. (ug/m3)
b
c
i
m
Site


Box & Whisker Plots
name = Trichloroethylene
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Conc. (ug/m3)
b
c
i
m
Site

1 in a million cancer risk air concentration = 0.033 µg/m3



Hexavalent Chromium in Ambient Air

Current USEPA Method

- **Developed by Eastern Research Group (ERG)**
  - **IC-UV method ($NaHCO_3$ pre-treated cellulose filter for collection, IC separation, post-column derivatization with diphenylcarbohydrazide, and UV detection at 540 nm)**
  - **MDL: 0.0074 ng/m^3**
- **Limitation**
  - **Can't monitor Cr(VI) ↔ Cr(III) interconversion**
  - **The recovery of Cr(VI) was determined by filter spiking method.**
  - **Stability of Cr(VI) during sampling and analysis has not been thoroughly evaluated.**

Summary of the EOHSI Cr(VI) Measurement Procedure

Air Sampling →
(Cellulose filter soaked by NaHCO3)

→ Sample storage at -15°C → Extraction
(HNO3 pH = 4.2; ultra-sonication for 40 min)

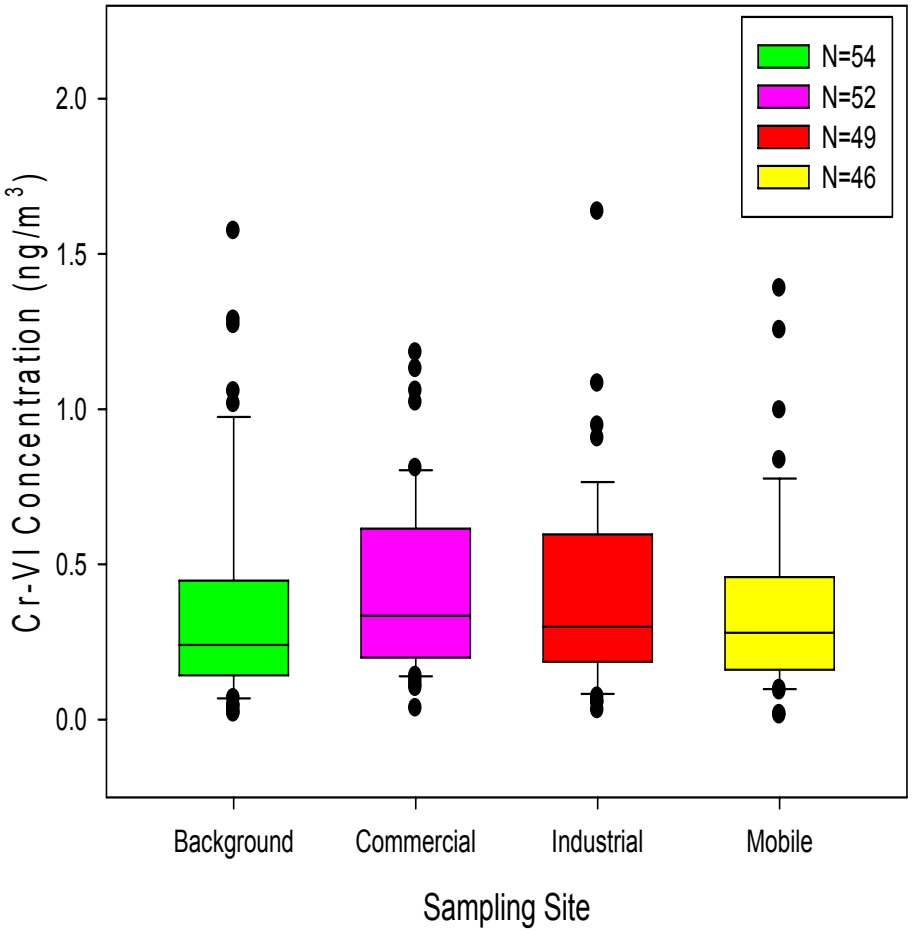
→ Ion Chromatography/Inductively Coupled Plasma Mass Spectrometry (IC/ICPMS)
(Two stage separation with HNO3 as mobile phase; ICPMS is tuned by In)

MDL = 0.18 ng/m^3

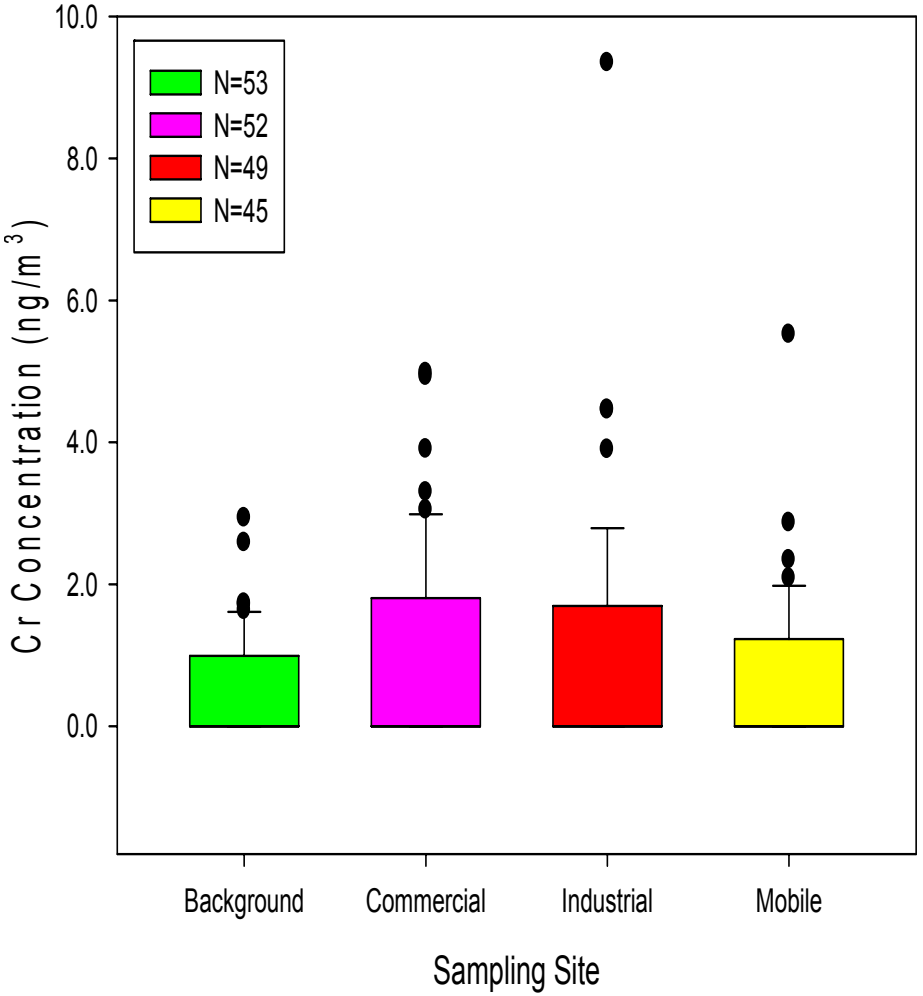
Future work

- Reduce lab blank Cr-VI levels
- Reduce/finalize inter-conversion rate between Cr(VI) and Cr(III)
- Investigate the impact of different environmental factors (O3, UV, temperature, aerosol type, etc.) on Cr(VI) measurement.
- Sampling and Analytical Methods Comparison

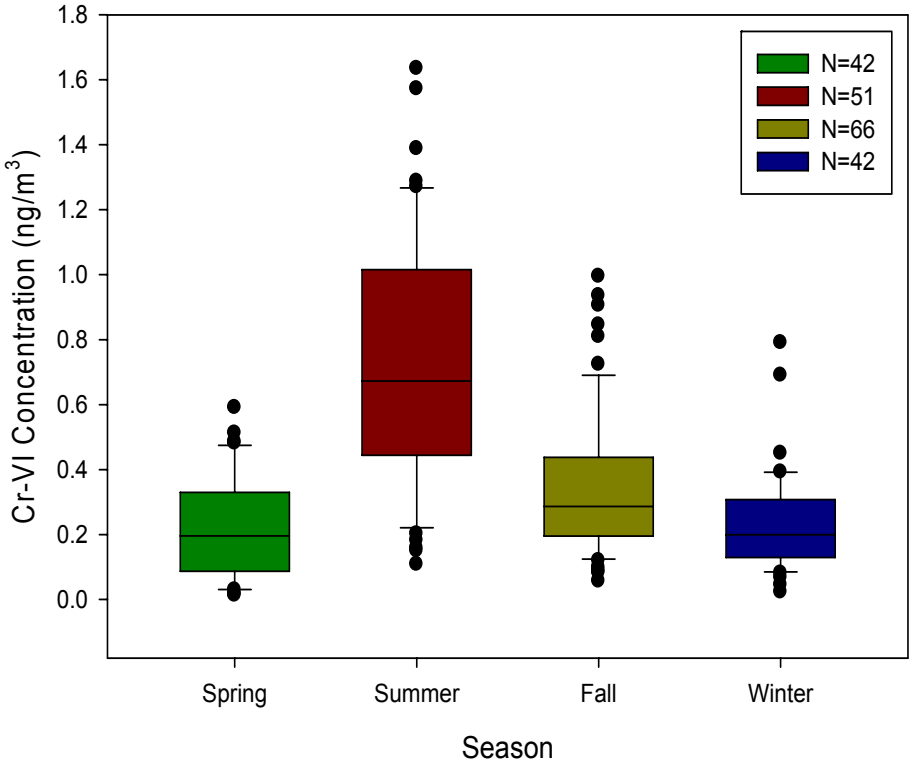
Box Plot for Cr-VI Concentrations in Air by Sampling Site



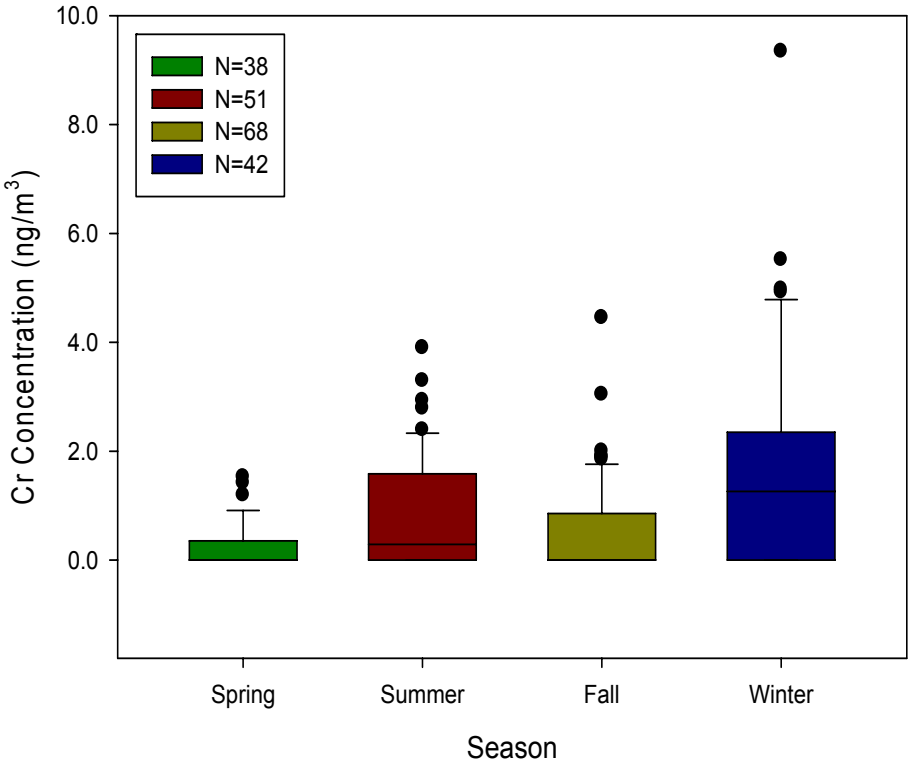
Box Plot for Cr Concentrations in Air by Sampling Site



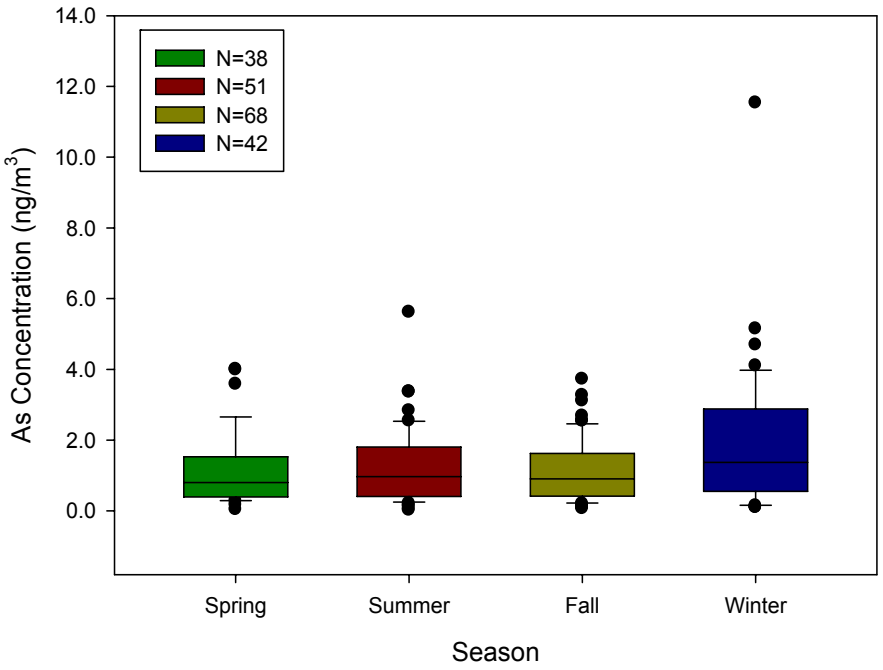
Box Plot for Cr-VI Concentrations in Air by Season



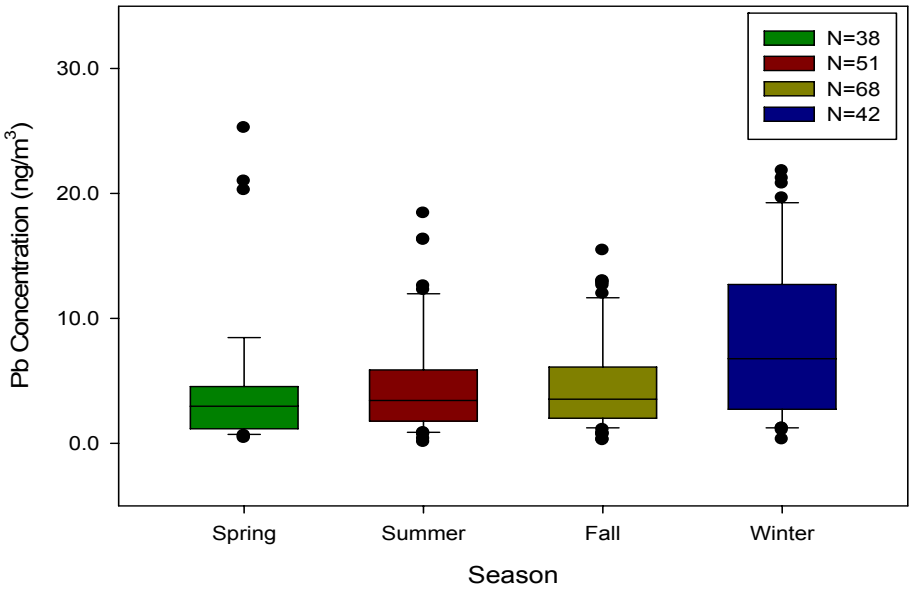
Box Plot for Cr Concentrations in Air by Season



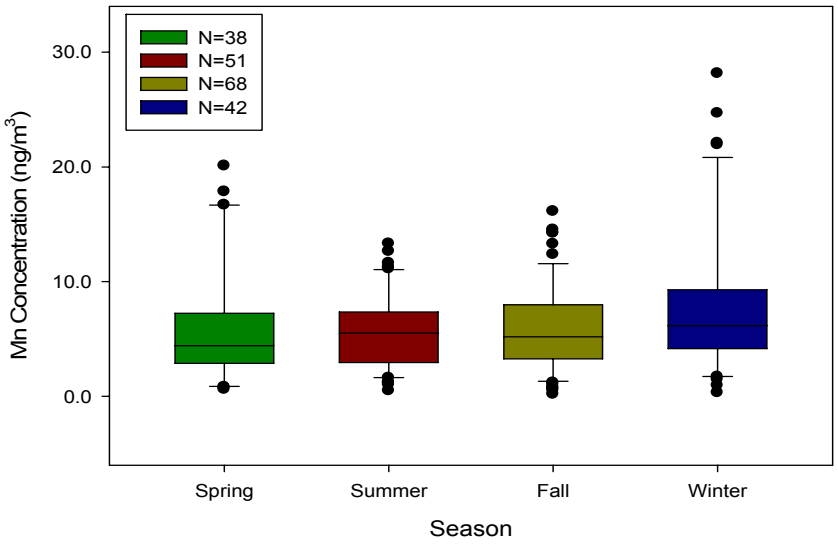
Box Plot for As Concentrations in Air by Season



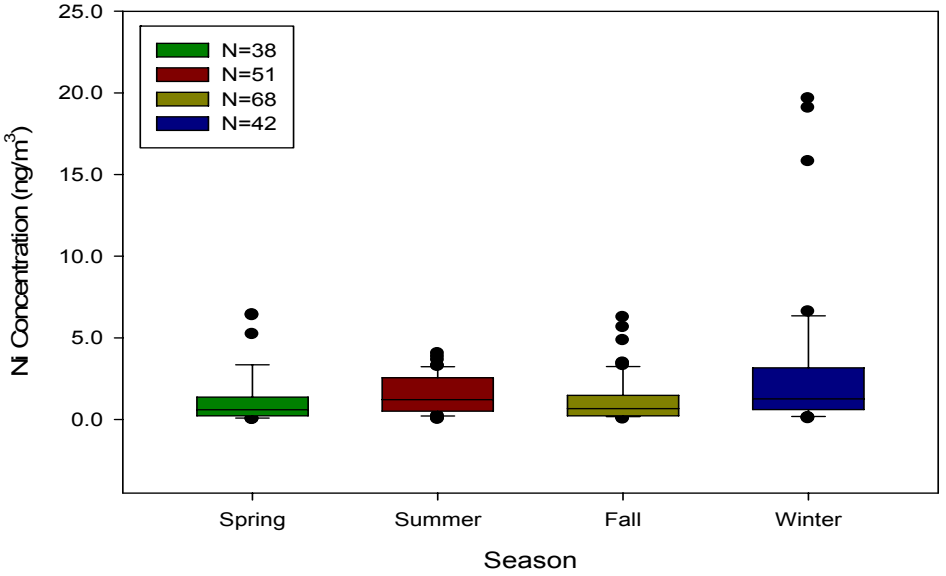
Box Plot for Pb Concentrations in Air by Season



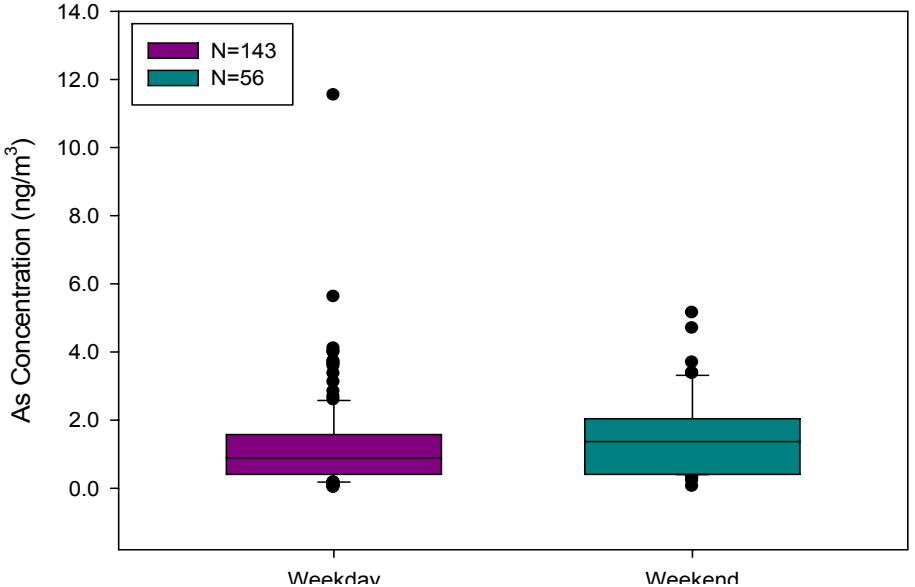
Box Plot for Mn Concentrations in Air by Season



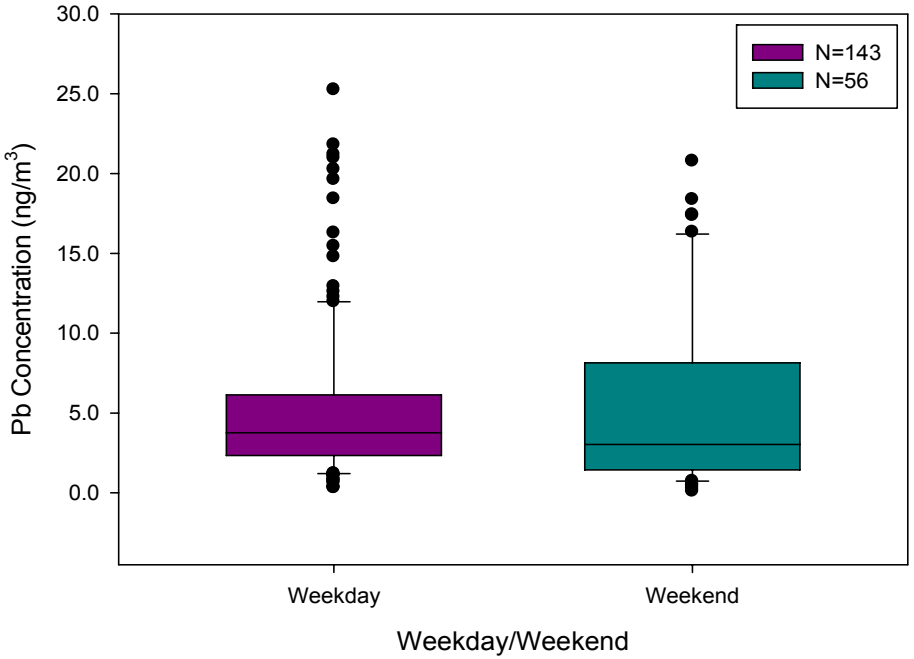
Box Plot for Ni Concentrations in Air by Season



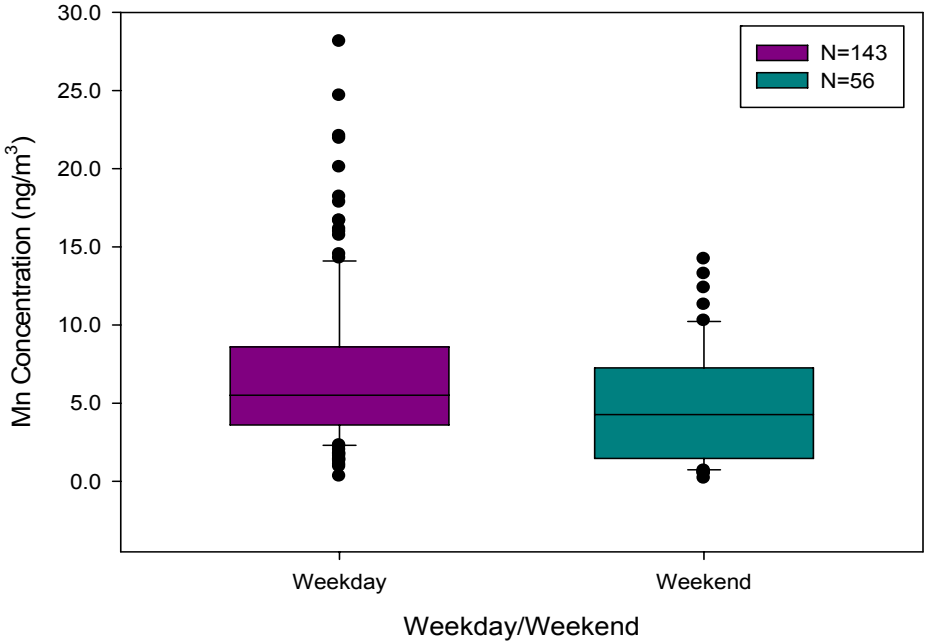
Box Plot for As Concentrations in Air by Weekday/Weekend

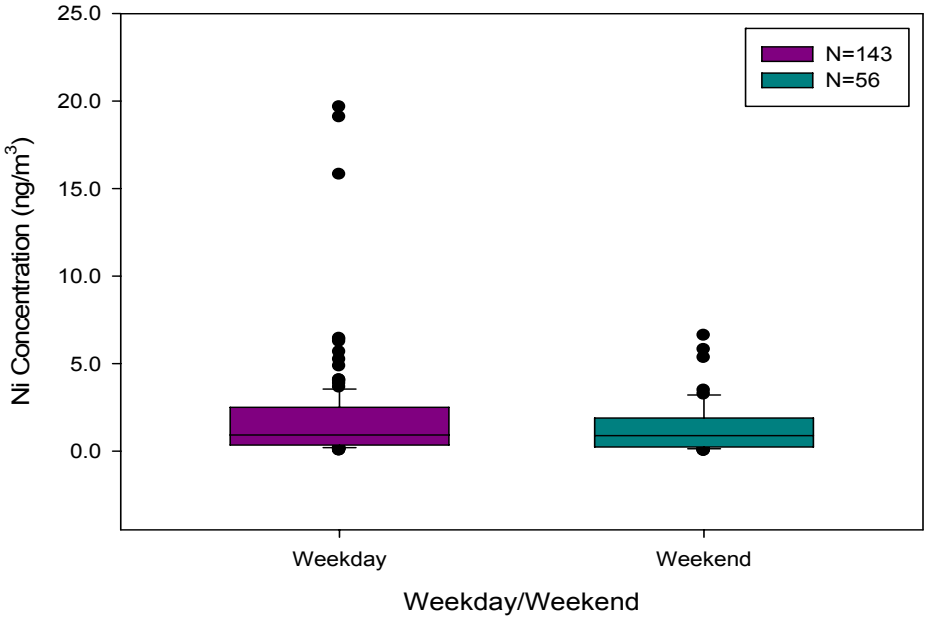


Box Plot for Pb Concentrations in Air by Weekday/Weekend



Box Plot for Mn Concentrations in Air by Weekday/Weekend



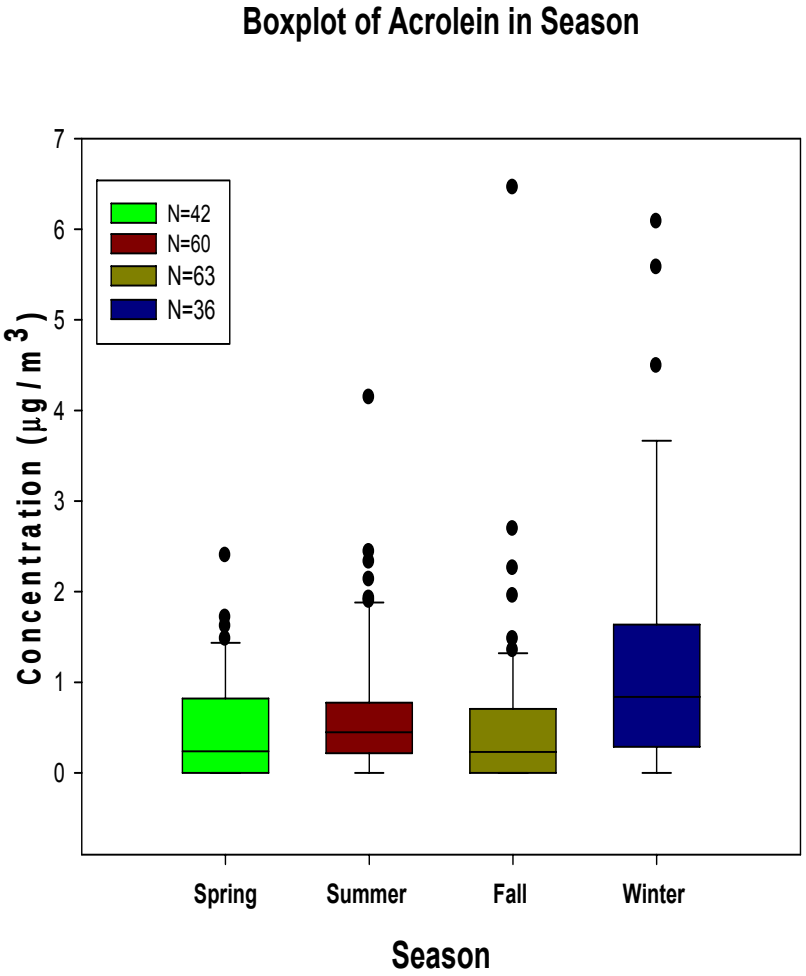


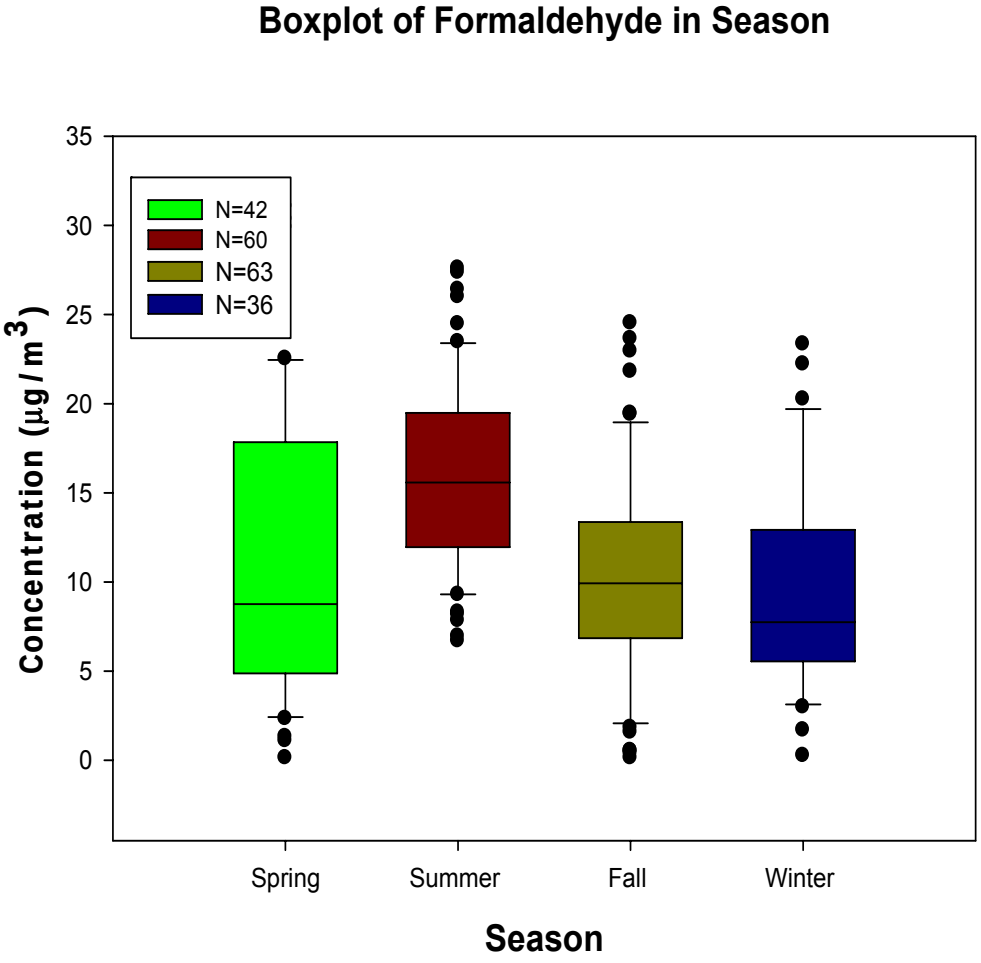
Carbonyls by Passive Aldehydes & Ketones Sampler (PAKS)

- 5-(dimethylamino)naphthalene-1-sulfohydrazide (DNSH) coated C_{18} cartridge and combined with analysis by HPLC-fluorescence technique (Zhang et al., 2000; Herrington et al., 2005)
- Provide a feasible sampling device for personal exposure measurement.
- Acrolein, Formaldehyde, Acetaldehye, Propionaldehyde

All were 100% detected at all sites

Carbonyl	MDL (ηg/m^3)	% difference n=26
Acetaldehyde	0.14-0.21	25-35
Acrolein	0.23-0.28	12-20
Formaldehyde	0.20-0.27	14-20


Boxplot of Acrolein in Season
N=42
N=60
N=63
N=36
Concentration (µg/m3)
0
1
2
3
4
5
6
7
Spring
Summer
Fall
Winter
Season


Boxplot of Formaldehyde in Season
N=42
N=60
N=63
N=36
Concentration (µg/m3)
0
5
10
15
20
25
30
35
Spring
Summer
Fall
Winter
Season

Risk Reduction Strategies

- During site visits, hand out colored 1/2 sheet of paper with 1-877-WARN DEP hotline #.

- Handed out EPA pamphlets ‘Reducing Air Pollution From….’
  - hospitals, dry cleaners, painting and coating operations, electroplating, metal operations…

Education on NJ Anti Idling Law
3 facilities bought multiple signs

- Found facilities that warrant additional scrutiny
  - textile manufacturing, dyeing and finishing
  - battery manufacturer
  - cable manufacture
  - electronics degreaser
  - Chemical/ nail polish manufacturer
  - manufacturers of metalloid packaging
  - extraction of botanicals
  - dry cleaners
  - autobody shops

3 facilities that emit lead all in same geographic area

- Initiated Modeling effort
- Informed Enforcement
- Next Steps
  - Stack Testing in Nov ‘07
  - discuss results with facilities
  - set up lead monitor
  - help them to upgrade grand-fathered sources
  - assist facility in obtaining better control technologies

Diesel Retrofit Possibilities

Discuss with NJDEP Diesel Reduction Team

- Hospital Generators
- Hospital Service Providers
  - laundry and food service companies
- Private Waste Hauler - 70 trucks have their home in Paterson

Other Outreach Activities

- Presentations to
  - 60 nurses from Paterson school district
  - PERC- Paterson Environmental Revitalization Commission
  - NJ Clean Air Council
  - Interagency Risk Assessment Committee
  - Paterson Public school students

During site visits handed out occupational surveys developed by NJDHSS

Importance of Community Projects

- Focus Resources on Community
- Partnership with Paterson School District
- Partnership with the University
  - capability to do non-routine monitoring over a limited amount of time
  - ability to oversee development of sampling and analytical methods for air toxics that are currently difficult to quantify
  - additional funds for Cr VI method development/ methods comparison

Some thoughts for additional community based monitoring projects

- Emissions Inventory/Site Visits first, then scope out monitoring program
- Target Compounds / Reduce MDLs
- Routine monitoring does not always provide information required for exposure & health effects assessments
  - Saturation Grid Sampling
  - Monitor 1 month/season
  - Monitor 1 week / season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GREATER PATERSON
LOU COSTELLO MEMORIAL INC.

Acknowledgements

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- NJDEP
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