

# **Status Report:**

## **NJDEP Community Air Monitoring Projects**

**USEPA Region 2**

**March 10, 2014**

Linda Bonanno, Ph.D., Olga Boyko, M.S.

NJ Dept. of Environmental Protection

Division of Air Quality

Bureau of Technical Services

Air Quality Evaluation Section



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# Previous Related Projects

- Staten Island/New Jersey Urban Air Toxics Assessment Project
  - 1987-1991, final report 1993
  - Community members took VOC samples
- Camden Waterfront South Air Toxics Pilot Project
  - Started fall 2002, final report 2005
  - Community members took Bucket Brigade Samples (limited participation by Community members)
- Urban Community Air Toxics Monitoring Project Paterson City, NJ (UCAMPP)
  - Monitoring 2005-2006, final report 2010
- Additional Air Monitoring in Paterson Study (AAMPS)
  - Monitoring 2009-2010, final report 2012

**Primarily funded by USEPA  
with in-kind resources contributed by NJDEP**

# Why is NJDEP Doing These Projects?

- To promote community involvement through air monitoring
- To test different methods for community air toxics monitoring
- To test viability of having community members take air samples
- To test different ways of implementing projects
- To determine how to use data effectively
- Education and awareness

# Air Monitoring Community Science Projects in New Jersey, 2012-2014

- Student Air Monitoring Project Lesson in Elizabeth (**SAMPLE**)
- South Ward Air Monitoring (**SWAM**)
- Student Air Monitoring Project (**SAMP**)
  - 3 schools in Paterson, 1 in Trenton, 1 in Westampton
- Citizen Air Monitoring in Ironbound, Newark (**CAMPIN**)

# Student Science Projects

(3 of the 4 NJDEP community science projects)

- Student Air Monitoring Project Lesson in Elizabeth (**SAMPLE**)
- South Ward Air Monitoring (**SWAM**)
- Student Air Monitoring Project (**SAMP**)

# Student Projects

- Primary objectives: **develop, implement, and evaluate** an ambient air monitoring **lesson plan for high school students**.
- Projects mostly located in urban communities, near heavily- trafficked roads and highways.
- Community members and groups have concerns about the potential health effects associated with emissions from vehicles/diesel trucks passing through their neighborhoods.



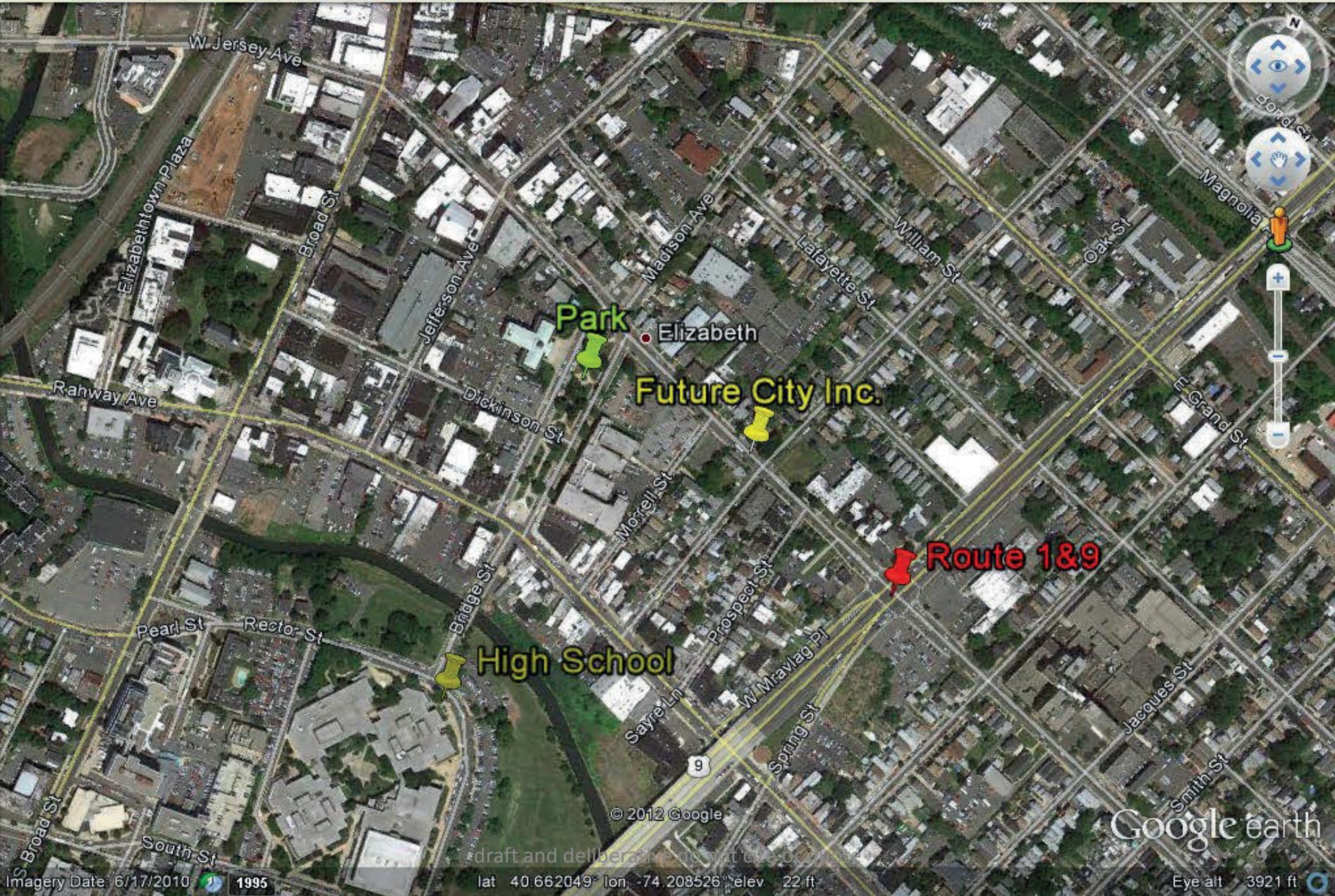
# 3 Student Science Air Projects

- Encourage student participation.
- Put air monitoring equipment (aethalometers) into the hands of students to measure concentrations of black carbon.
- Learn about black carbon emissions, sources, environmental and potential health impacts.
- Learn to apply the scientific method to develop a hypothesis and a methodology to answer scientific questions.
- Produce a web-based resource for students to use with little oversight from NJDEP. NJDEP will lend out equipment/track usage. DAQ partnering with Communications Office.

# ***Student Air Monitoring Project Lesson in Elizabeth (SAMPLE)***

- Contracted with Future City Inc. (FCI) of Elizabeth, a local community group
- Contracted with RU for technical support
- Recruited about 10-15 students
- Students met ~1-2 day(s)/month from Oct. 2012- May 2013, in weekend/holiday program
- Learned about air pollution and human health, diesel emissions, sources in community
- Students monitored black carbon on 2 days, on a workday and a weekend, near and far from roadways
- Presented results at FCI's Environmental Day in April 2013 & at NJDEP in May 2013





Park

Elizabeth

Future City Inc.

Route 1&9

High School

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Google earth

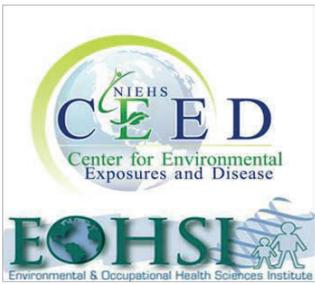




# SAMPLE

## Staff & Student Leaders





# South Ward Air Monitoring Project (SWAM)



- Contracted with RU, who subcontracted with the New Jersey Environmental Justice Alliance (NJEJA)
- In-school project implemented over marking period at Central High School (Newark Public Schools).
  - South Ward, Newark, New Jersey
  - 28 9<sup>th</sup> grade students
  - Environmental justice component



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# SWAM (cont'd)

- RU & NJEJA staff taught lessons in-class using PowerPoint presentations that they developed.
- Focused on air pollution, human health, diesel emissions, and other air pollution sources in community.
- Strong Environmental Justice component.
- Students learned how to do a scientific study, perform basic statistics, and write a lab report.



# SWAM (cont'd)

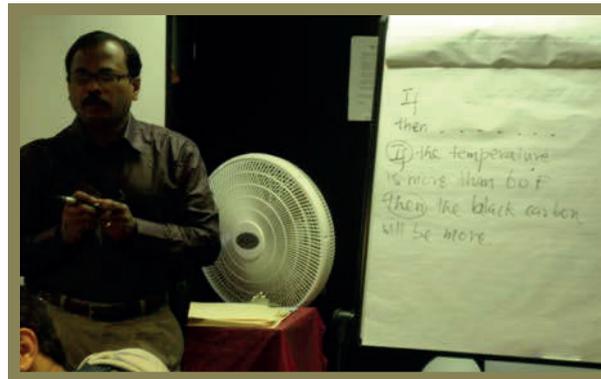
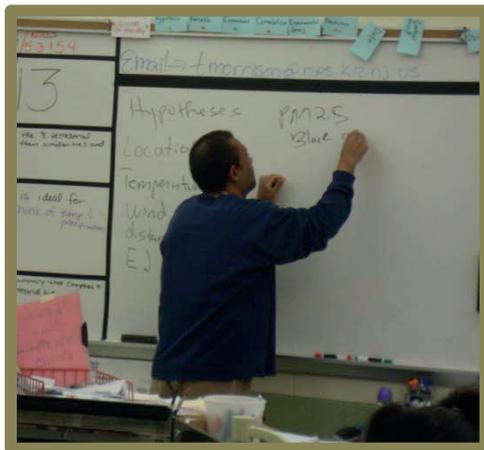
Since the SWAM project took place during a marking period, extra activities were able to take place.

- Pre- and post-tests were given to SWAM students to measure their knowledge of air pollution, environmental justice and to evaluate the overall project.
- SWAM students took a field trip to Rutgers University to talk with researchers and tour research labs.



# SAMPLE & SWAM - Developing a Hypothesis

Students participated in the development of research questions and designs to characterize the impact of traffic on air pollution in their communities.



# **SAMPLE & SWAM - Choosing Locations for Air Sampling**

Students chose which locations to perform air sampling to test their hypotheses.

- With input from project leaders
  - Student safety, security and accessibility are important
- Generally, to characterize/compare:
  - High, moderate, low traffic areas
  - Locations (near/far roadways)
  - Work day /non work day

Students were split into groups to collect samples/ duplicates: always with supervision.

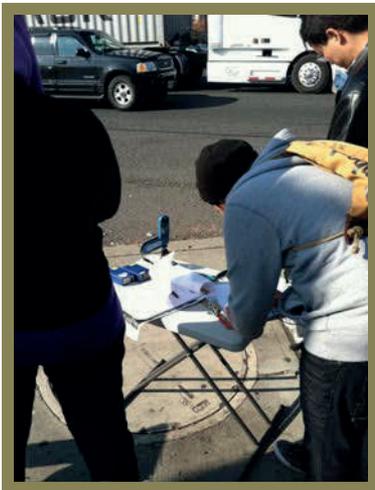
# STUDENT AIR MONITORNG PROJECTS- Using Air Monitoring Equipment

Students were introduced to the air monitoring equipment they would be using (aethalometers) and practiced using the equipment for several days.



# SAMPLE - Field Sampling Days

- In Elizabeth, the SAMPLE students chose to take air samples from the intersection of Routes 1&9, a very heavily-trafficked intersection, near sources
- Simultaneously sampled air from a nearby park (low traffic area, far from sources) for comparison.
- On workdays and non-workdays

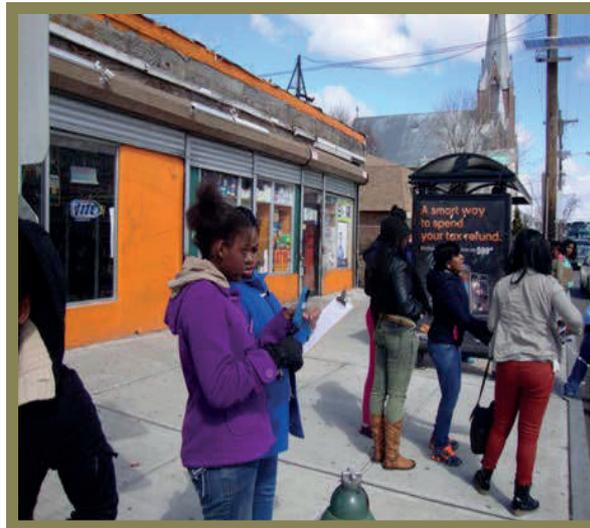


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# SWAM - Field Sampling Days

In Newark, the SWAM students performed air sampling at three locations:

- Springfield Avenue, a highly-trafficked area
- Irvine Turner Blvd, a moderately-trafficked area
- Nat Turner Park, a low-trafficked area



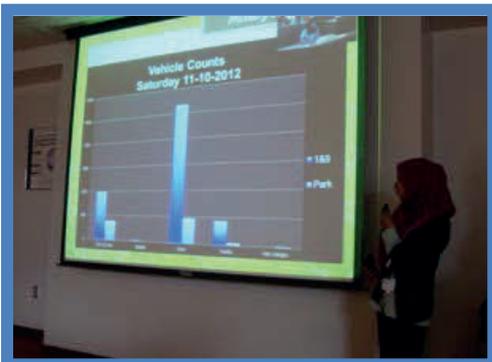
# SAMPLE & SWAM - Data Analysis

- After sampling, the students organized, QA/QC'd and performed data analysis
- Students assessed the impact of location, truck traffic, vehicle type counts, day of week and meteorological factors on the black carbon levels in their communities.



# SAMPLE & SWAM - Presentations

- The students prepared presentations and presented at the annual meeting of the Tri-State Chapter of the International Society of Exposure Science at the Rutgers University.
- SAMPLE students also presented their results to the NJDEP Commissioner & staff and participated in a career session with NJDEP staff.



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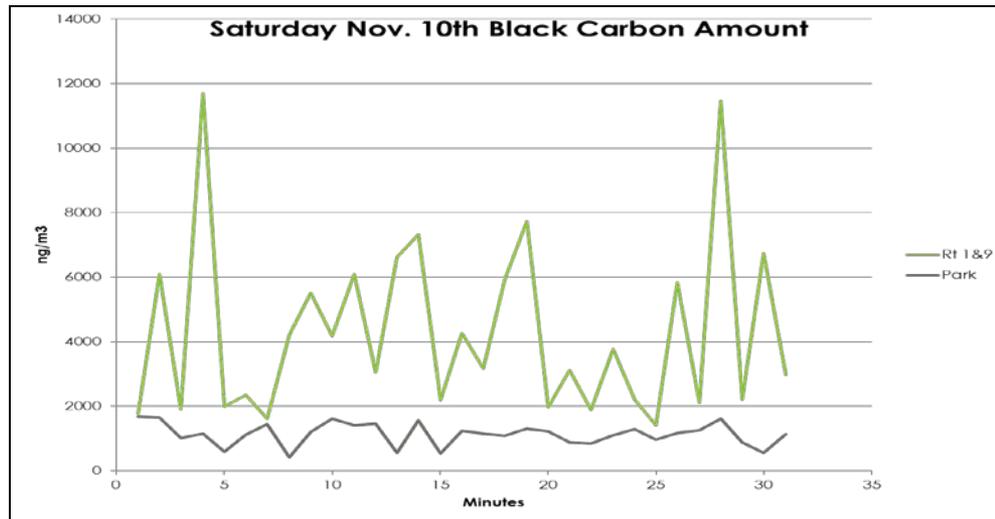


22

# SAMPLE Presentation Day at NJDEP



# Example of SAMPLE Data Analyses/Results

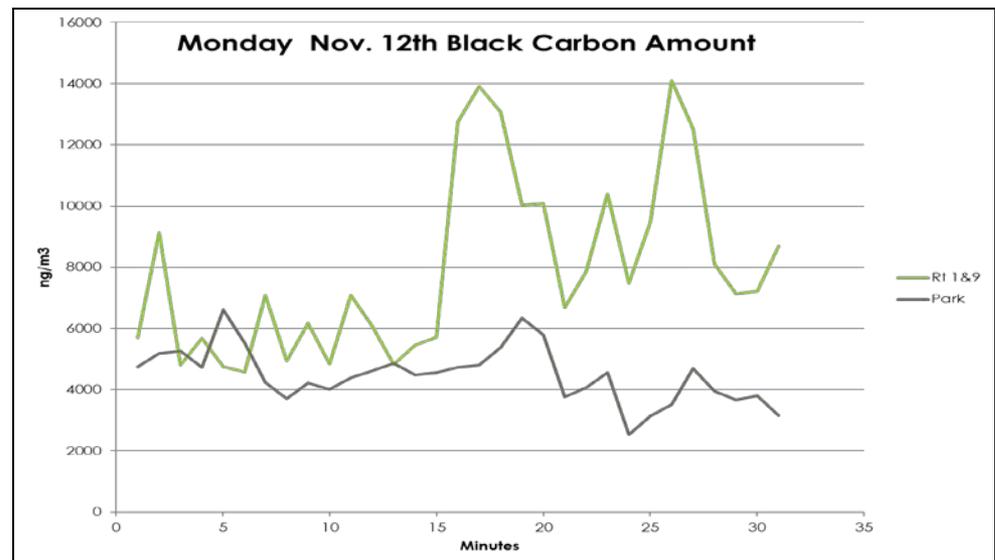


**Mean at Rt. 1&9:  
4306 ng/m<sup>3</sup>**

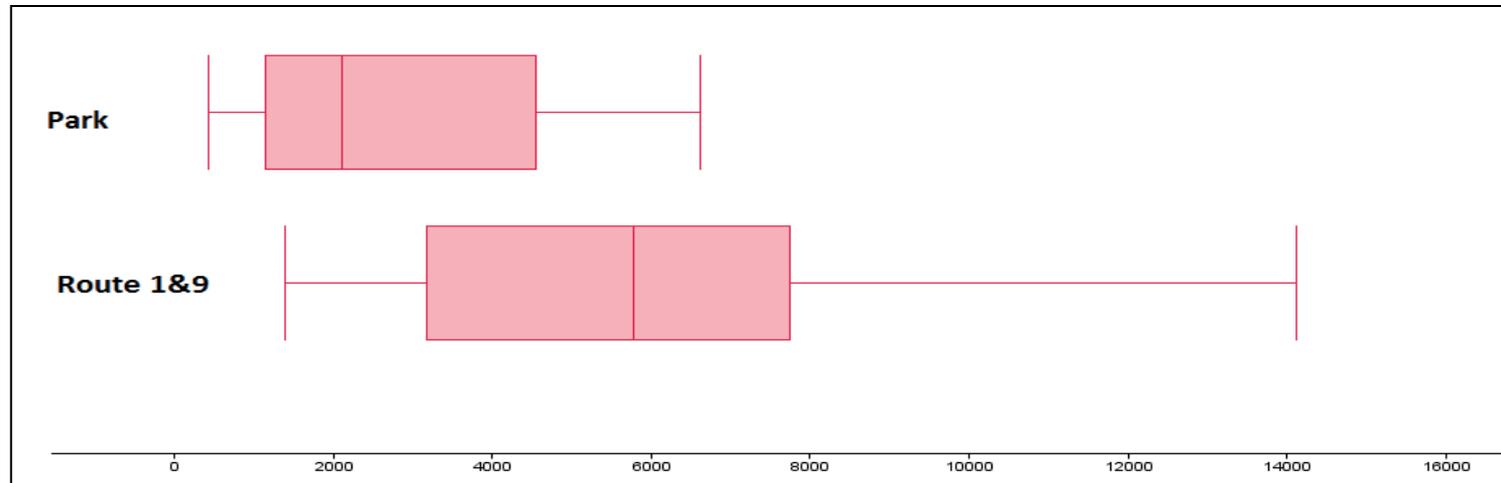
**Mean at Park:  
1133 ng/m<sup>3</sup>**

**Mean at Rt. 1&9:  
7948 ng/m<sup>3</sup>**

**Mean at Park:  
4485 ng/m<sup>3</sup>**



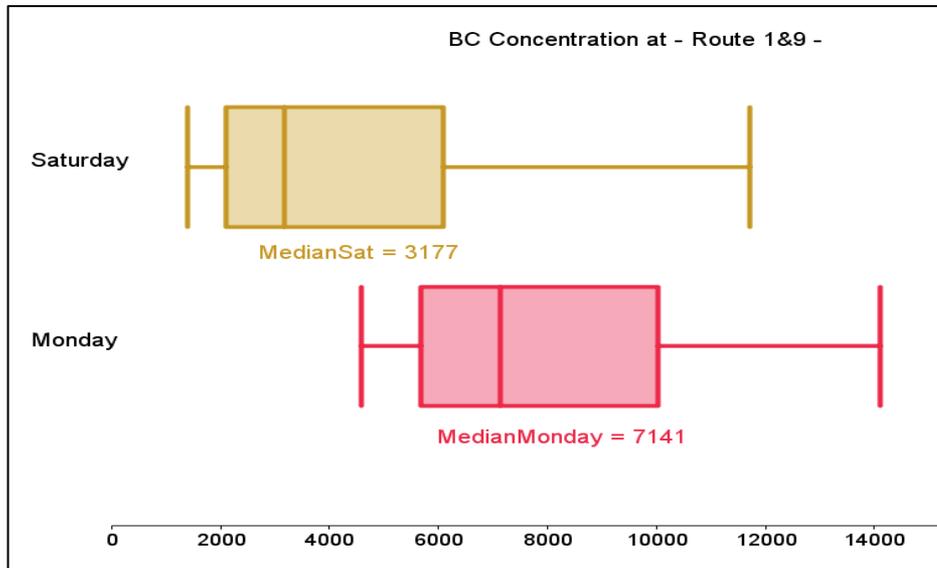
# Example of SAMPLE Data Analyses/Results



Statistics	BC (ng/m3)	
	Park	1&9
mean	2809	6127
median	2111	5772
standard deviation	1821	3351
range	6188	12703

From the data and the graph above we can see that the average concentration of BC measured at Rts. 1&9 is 218% higher than at Bridge Street Park. The major reason for the higher concentration at Rts. 1&9 is the greater number of vehicles, especially trucks.

# Example of SAMPLE Data Analyses/Results



The graph at left shows the BC concentrations on Saturday and Monday. According to the graph, the median on the weekend is less than the median on a weekday.

Statistics at Route 1&9	BC (ng/m3)	
	Saturday	Monday
mean	4306	7948
median	3177	7141
standard deviation	2732	2919
range	10310	9522

The table at right shows that there is big difference in BC levels on a weekday compared to the weekend. The mean is 85% higher on Monday than on Saturday at Rts.1&9.

# SAMPLE & SWAM - Project Summaries

Through participation in these air monitoring projects, the students increased their awareness of air pollution and air monitoring; developed an interest in environmental science/public health; and learned new skills in statistics, excel, mapping, making presentations and public speaking.



draft and deliberative do not cite or quote



# ***Student Air Monitoring Project (SAMP)***

- NJDEP put out RFP through Treasury with guidelines for project.
- Researchers were to develop an educational module to be used again and again.
- Focus on overburdened communities.
- Experts in the field submitted proposals with detailed work plans, budget and timeframe.
- Selection made by 2 NJDEP staff and 1 staff from Treasury, based on:
  - Personnel, experience, ability to complete project, cost, etc.

# SAMP (cont'd)

- Awarded to Advanced Monitoring Methods, consultant from Colorado
- With assistance from NJDEP:
  - Recruited 5 schools
  - Tested in classrooms
  - Total cost \$50,000 for 5 schools
  - Finished product is a web-based program that can be accessed and implemented by any interested party, with focus on students



# SAMP (cont'd)

An **aetholometer** is used to measure levels of black carbon.



# SAMP Schools & Field Sampling Locations

- JFK STEM, Paterson
  - Sampled around school, busy intersection.
- Garrett Academy, Paterson
  - Location, elevation.
- PANTHER Academy, Paterson
  - Information was not supplied by contractor.
- Village Charter School, Trenton
  - Sampled at different distances from canal, gas station, trees
- Friends Academy, Westampton
  - Wooded area, parking lot, school, distribution center
  - Near & far from busy road
  - At busy intersection with stopped & moving traffic



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## Student Air Monitoring Project

### WELCOME



**Description:** Students will research the characteristics, sources and impacts of particulate air pollution at a location in their neighborhood or community. They will use this information to develop and complete a data collection study of this local area and suggest actions (policies or practices) that can be taken to reduce or prevent particulate air pollution impacts there. Students will have the opportunity to borrow particulate air study from the NJ Department of Environmental Protection. As a result, students will:

- Practice using the scientific method;
- Collect data using scientific technology that may be new to them;
- Conduct an interactive, hands-on experiment in the field (versus classroom or lab); and
- Increase their understanding of air pollution contributions, causes and solutions.

**Grade Level:** 7-12

**Subject:** Science

**Support for the NJ Core Curriculum Content Standards:** [Click here](#)

**Keywords:** air pollution, soot, black carbon, particulates, emissions, air monitoring

**For more information contact:**

[Olga Rovito](#), Environmental Specialist 3  
New Jersey Department of Environmental Protection  
Air Quality Permitting Program  
Bureau of Technical Services  
Air Quality Evaluation Section  
609-632-1100



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Last Updated: December 3, 2012



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## Student Air Monitoring Project

### DATA EVALUATION



One of the most important aspects of scientific studies is communicating the results to your peers as well as adults who are interested in your work. Refer often to the lab report rubric below to ensure that your lab report is complete and accurate.

 **Lab Report Rubric**  
This is the rubric that will be used to evaluate your lab report. Be sure to check your report to determine if you have addressed all parts of the assignment.



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## Student Air Monitoring Project TEACHER'S ASSESSMENT



We value your feedback! Please fill out the evaluation form (click on the "Teacher's Assessment Rubric") and send it back to [olqa.boyko@dep.state.nj.us](mailto:olqa.boyko@dep.state.nj.us).



[Teacher's Assessment Rubric \(docx\)](#)

# SAMP Next Steps

- Post on the web under the NJDEP State Environmental Education Directory (SEEDS) .
- Also link through Division of Air Quality web site.
- Announce availability by NJDEP Communication Office through science teachers' conventions, mailing lists, etc.

# Status Report

## Citizen Air Monitoring Project

### in Ironbound, Newark (CAMPIN)

**May 6, 2014**

Linda Bonanno, Ph.D., Olga Boyko, M.S.,

NJDEP, DAQ, BTS, AQEv

Ironbound Community Corporation



**Ironbound**  
**COMMUNITY**  
**CORPORATION**

draft and deliberative do not cite or quote



# Background: USEPA Region 2 Citizen Science

## **Enlists community members:**

- To collect data over array of communities & environments;
- To expand scientific knowledge & literacy;
- For public engagement, education and outreach.

## **Modern citizen science has more emphasis on:**

- Scientifically sound practices & measurable goals;
- Increased access and scale of public participation.

*New technology has helped to make this possible.*

## **USEPA Region 2 has expanded citizen science to:**

- Provide tools, education, training to directly monitor environment;
- Work towards solutions of identified environmental problems.

# CAMPIN Project Goal

- Test different methods for community air pollution monitoring:
  - engaging/organizing community members
  - monitoring methods
- Test viability of having community members take air samples
- Test different ways of implementing project(s)
- Education and awareness
- Determine how to use data effectively

# NJDEP Community Science Projects

- Citizen Air Monitoring Project in Ironbound Newark (CAMPIN)
- Student Air Monitoring Project Lesson in Elizabeth (SAMPLE)
- South Ward Air Monitoring (SWAM)
- Web-based Student Air Monitoring Project (SAMP)

# Outcome of SAMP: Web-Based Product

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**Student Air Monitoring Project**  
**WELCOME**



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**Description:** Students will research the characteristics, sources and impacts of particulate air pollution at a location in their neighborhood or community. They will use this information to develop and complete a data collection study of this local area and suggest actions (policies or practices) that can be taken to reduce or prevent particulate air pollution impacts there. Students will have the opportunity to borrow calibrators for this study from the NJ Department of Environmental Protection. As a result, students will:

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# Overview of CAMPIN Sampling

- Air sampling ~ 7 months: Dec.2012-June 2013
- Fixed site in Ironbound: 24-hr. volatile organic compound (VOC) samples (TO-15 canisters)
  - 1-in-6-day sampling; same as other air pollution monitoring locations around state
  - To help put into context the grab (1-hr.) samples taken by community members, and for QA/QC
  - To compare averages to other monitor locations
- Community members took 1-hour grab samples in the community
  - Determined where & when they wanted to take samples, with appropriate QA/QC samples
  - Sampled during truck-counting exercise

# Overview of CAMPIN Sampling

- **41** 1-hour samples were taken by community members around the community
- **32** 24-hour samples were taken at the fixed sampler at the ICC building: Elm & Van Buren Streets.

# CAMPIN Sampling Locations



draft and deliberative do not cite or quote



# Canister used in CAMPIN with “candy cane” orifice & pressure gauge for 1-hour sample

(Photo courtesy of NYSDEC)



draft and deliberative do not cite or quote

# Conclusions

- **None of the pollutants measured during CAMPIN exceeded their short-term health benchmarks.**
- Some 1 hour samples from South Street area captured higher concentrations of some pollutants.
- These higher concentrations may have been influenced by meteorological factors, i.e., these samples were obtained on very low wind speed days.

# Pollutants Measured and Detection Limits

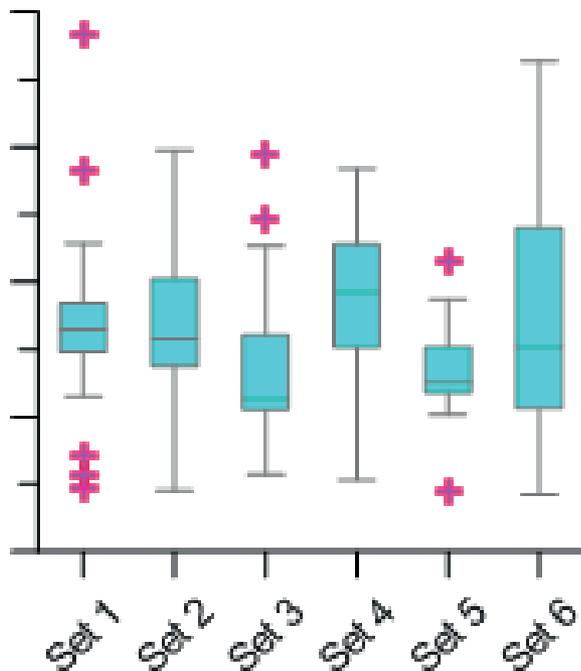
- Method USEPA TO-15 measures 58 pollutants; used nationally.
  - 9 pollutants were **never** above their detection limits.
  - 10 pollutants were **above** their detection limits **in less than 10%** of the samples.
  - Graphs that follow show detection limit when relevant.

# CAMPIN Air Sampling Results

- We compared measured concentrations to NJDEP's permanent air monitoring stations; 24-hour air samples taken every 6 days:
  - **Chester** (Morris Co.) ~ rural area
  - **Elizabeth** (Union Co.) ~ mobile source area
  - **New Brunswick** (Middlesex Co.) ~ suburban area
- **Community** samples taken around Ironbound: samples were taken by community members at different places, days, times for approximately 1 hour.
- ICC building at **Elm & Van Buren Sts.:** samples taken on same schedule/time as NJDEP monitors.

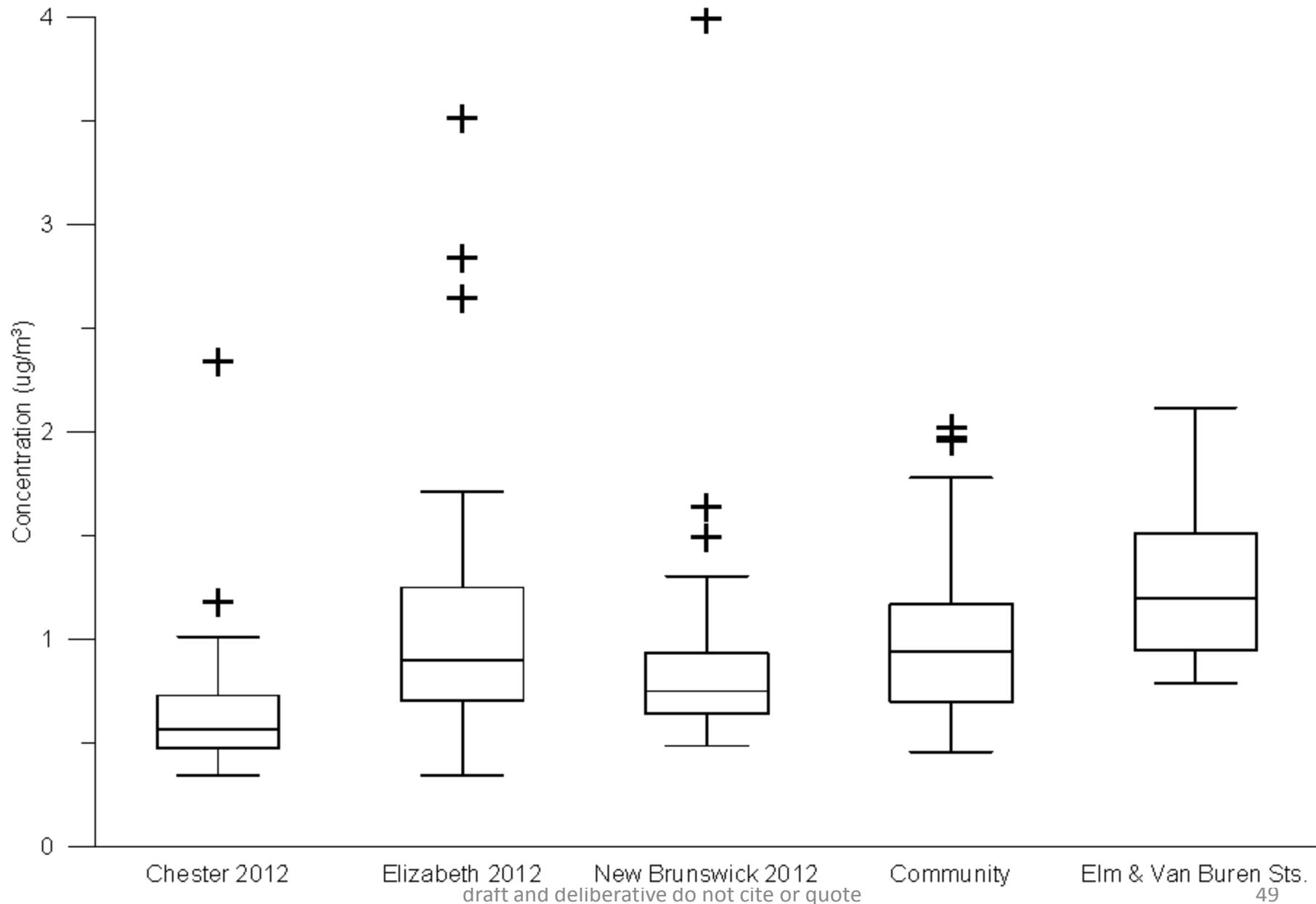
# CAMPIN Data - Box & Whisker Plots

Box-Whisker plots show minimum, maximum, median, lower quartile (25<sup>th</sup> percentile), and upper quartile (75<sup>th</sup> percentile) information for groups of data.



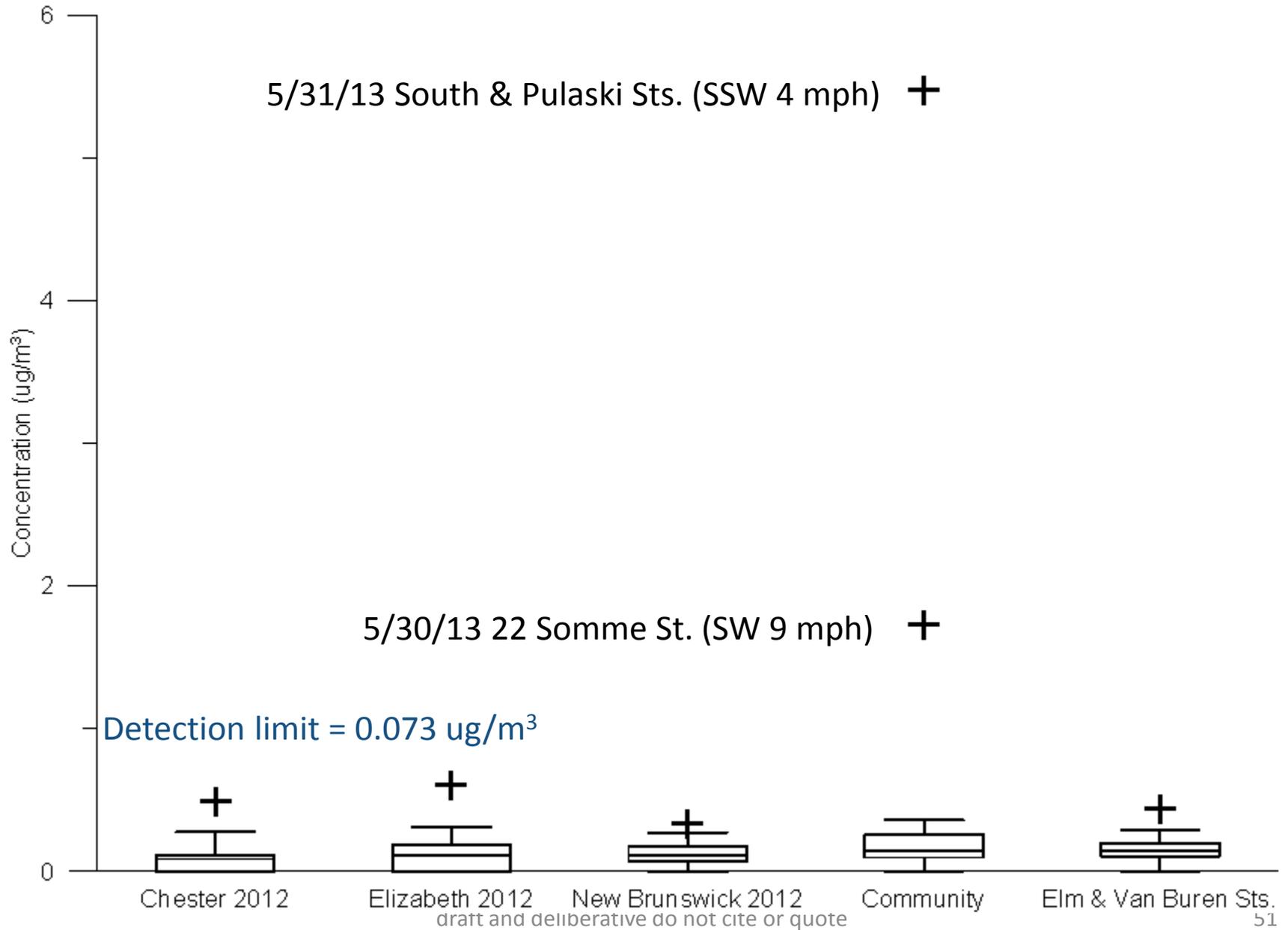
The “+” shows data that is outside the range expected, based on the software’s interpretation of the rest of the data.

# CAMPIN - Benzene



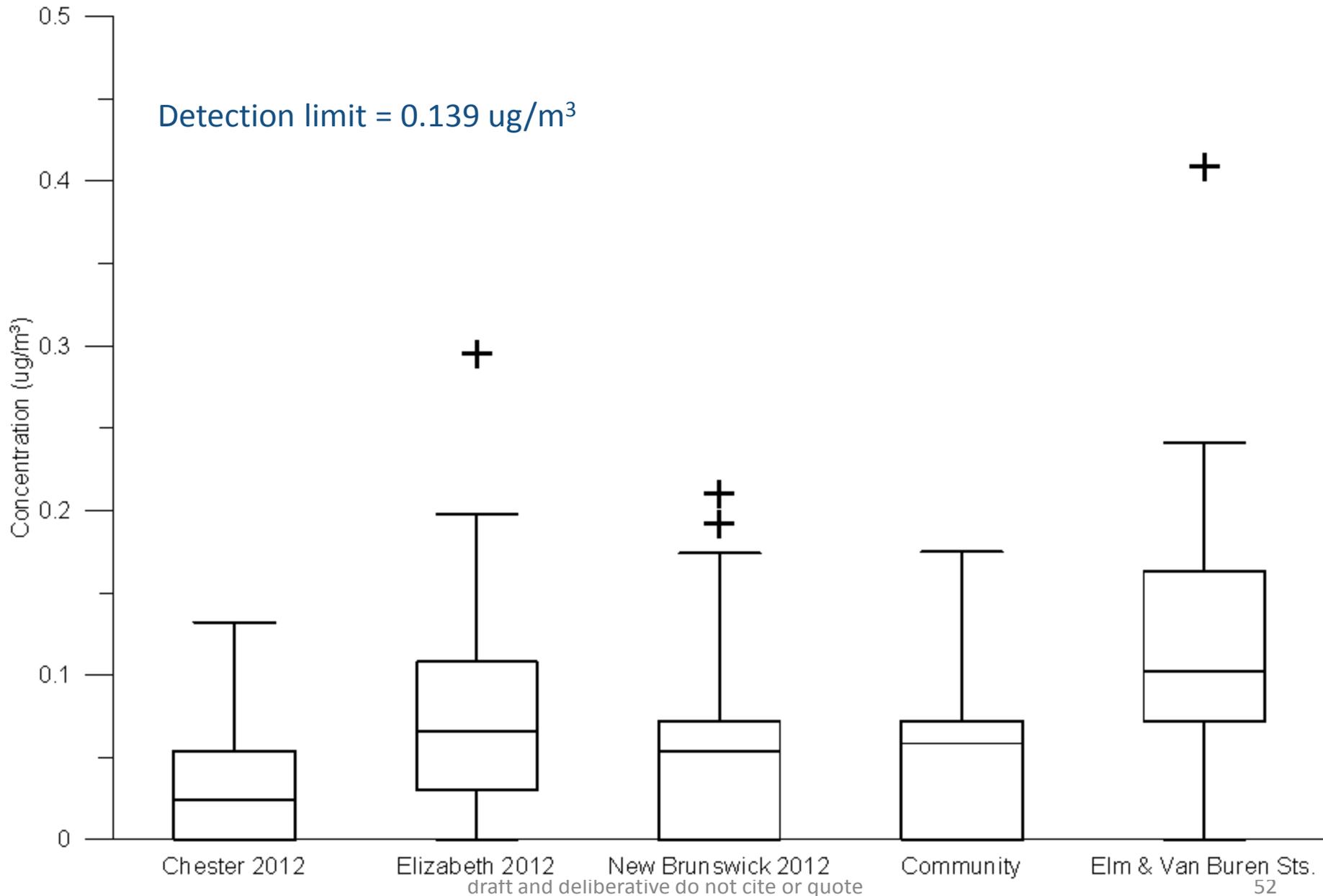


# CAMPIN - Chloroform

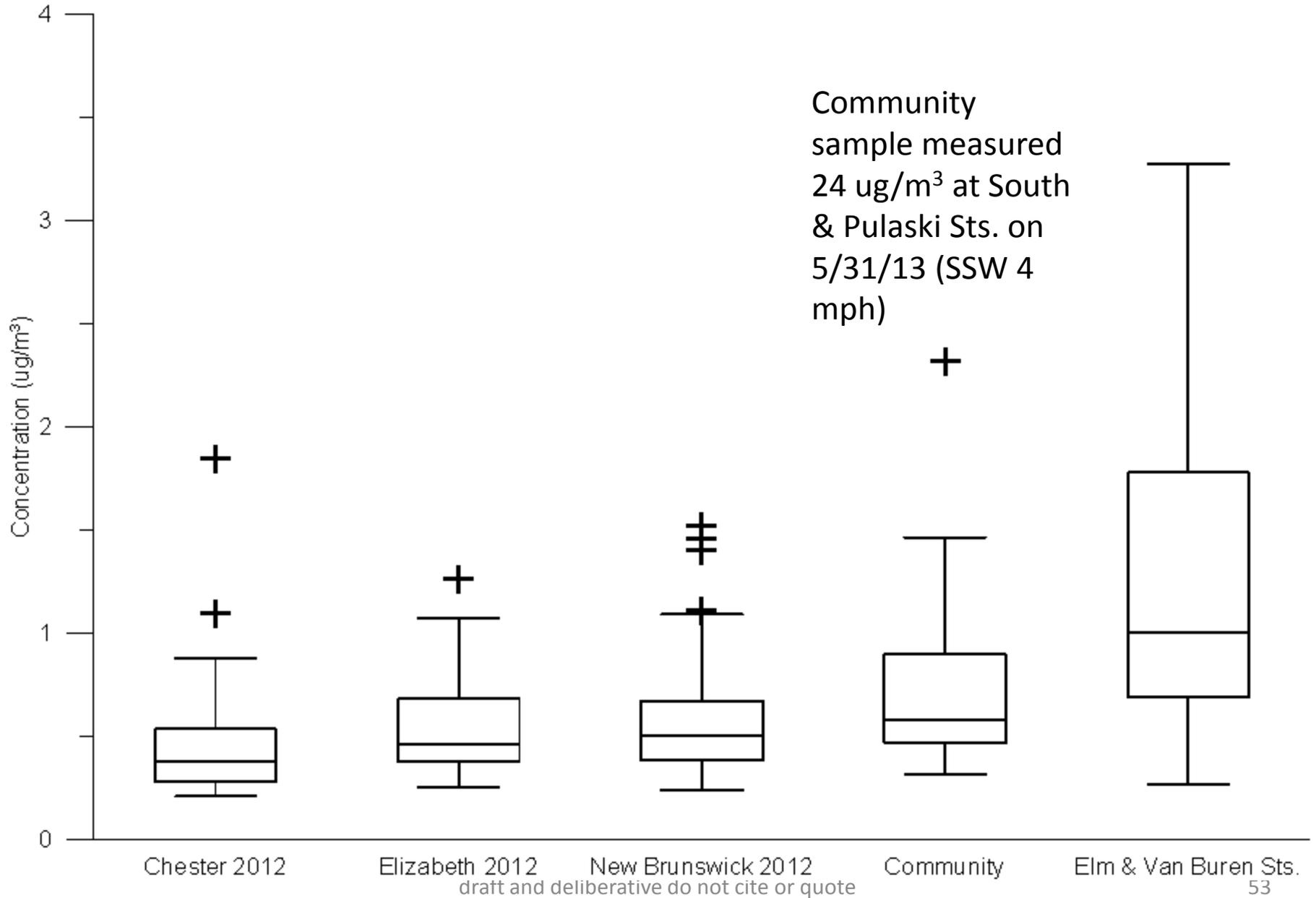


# CAMPIN - p-Dichlorobenzene

Detection limit = 0.139  $\mu\text{g}/\text{m}^3$

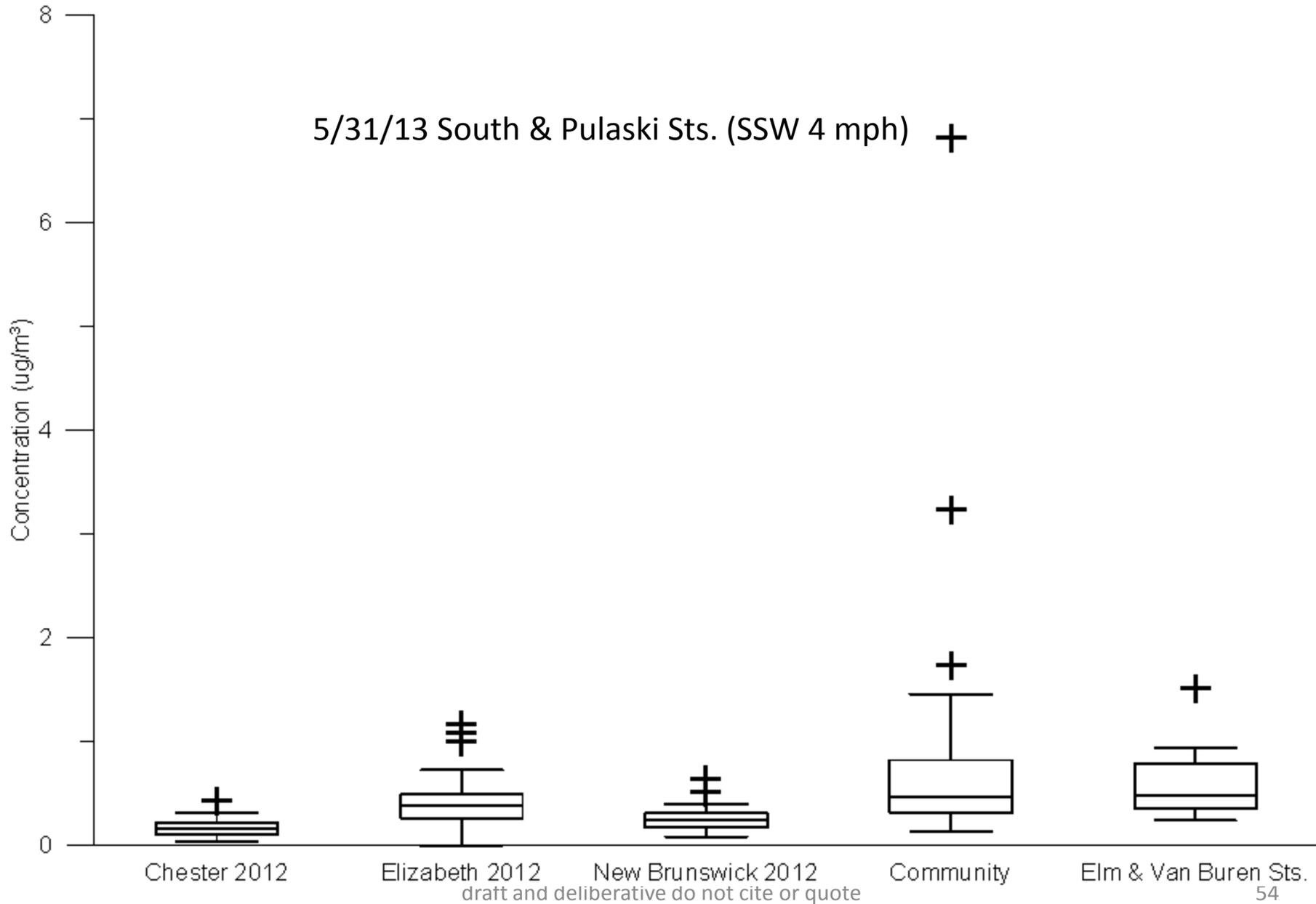


# CAMPIN - Dichloromethane (Methylene Chloride)



# CAMPIN - Ethylbenzene

5/31/13 South & Pulaski Sts. (SSW 4 mph) +

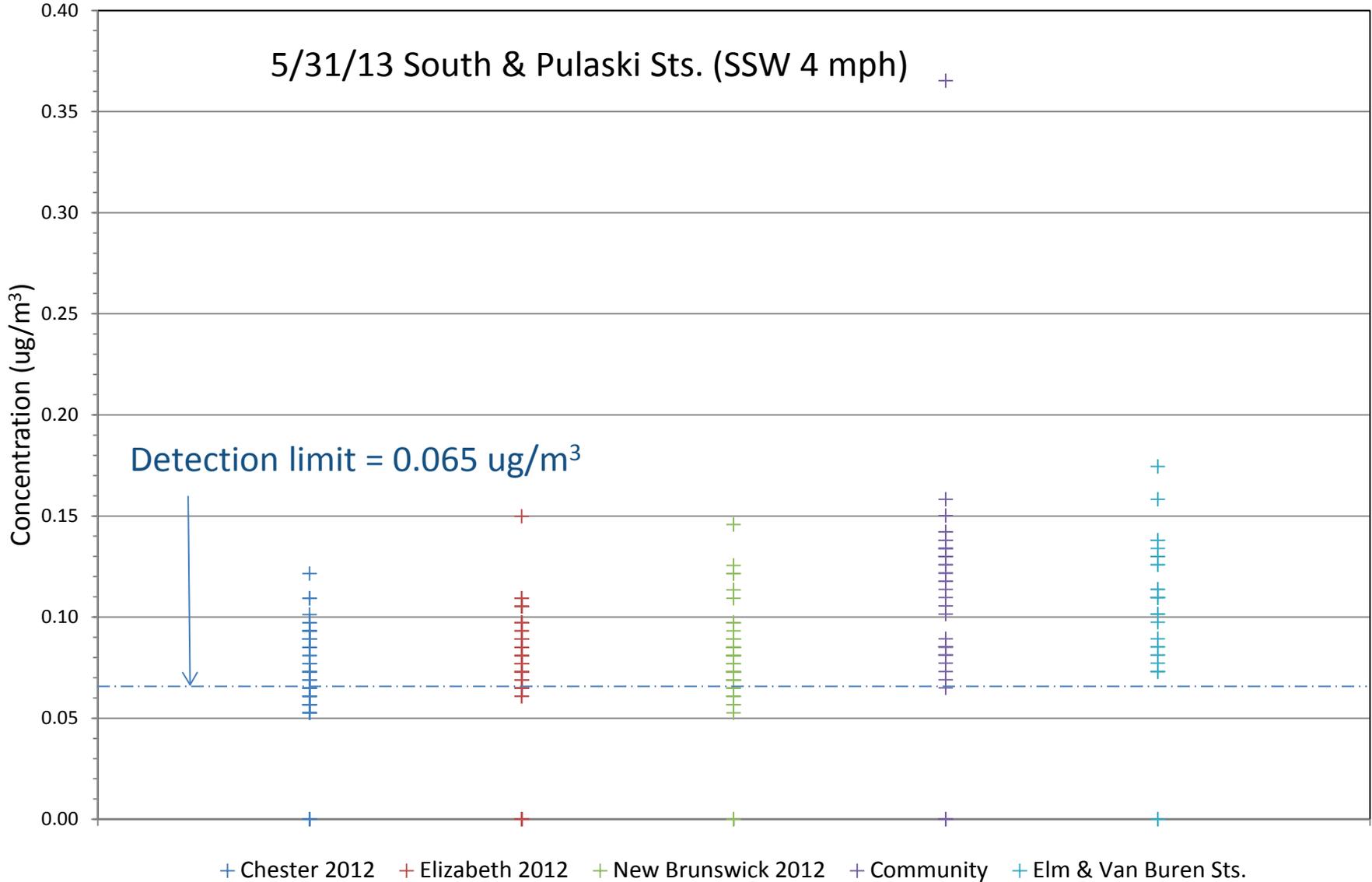


# CAMPIN Data - Strip Plots

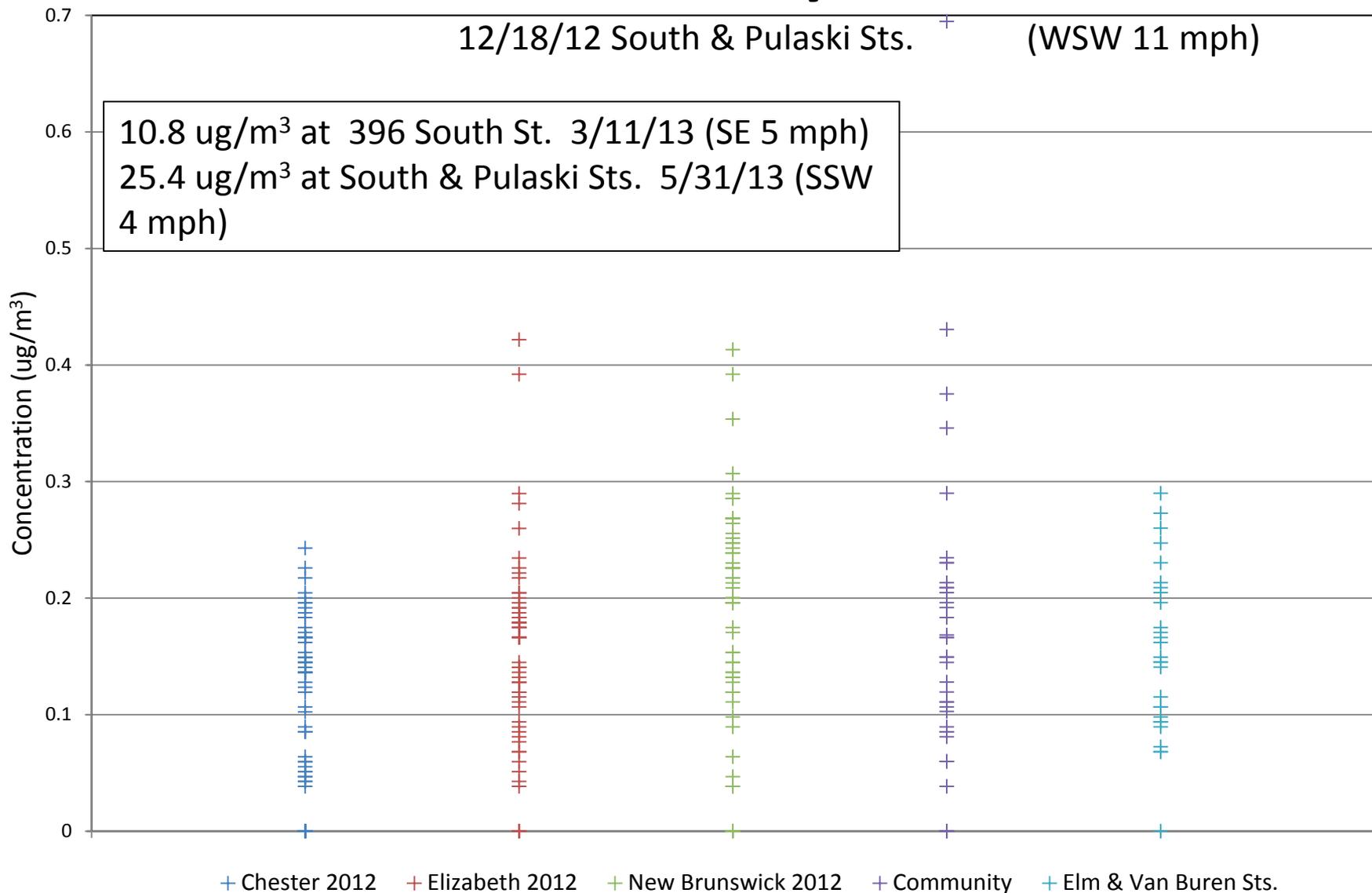
- All sample data are presented
- Data are not averaged

# CAMPIN - 1,2-Dichloroethane

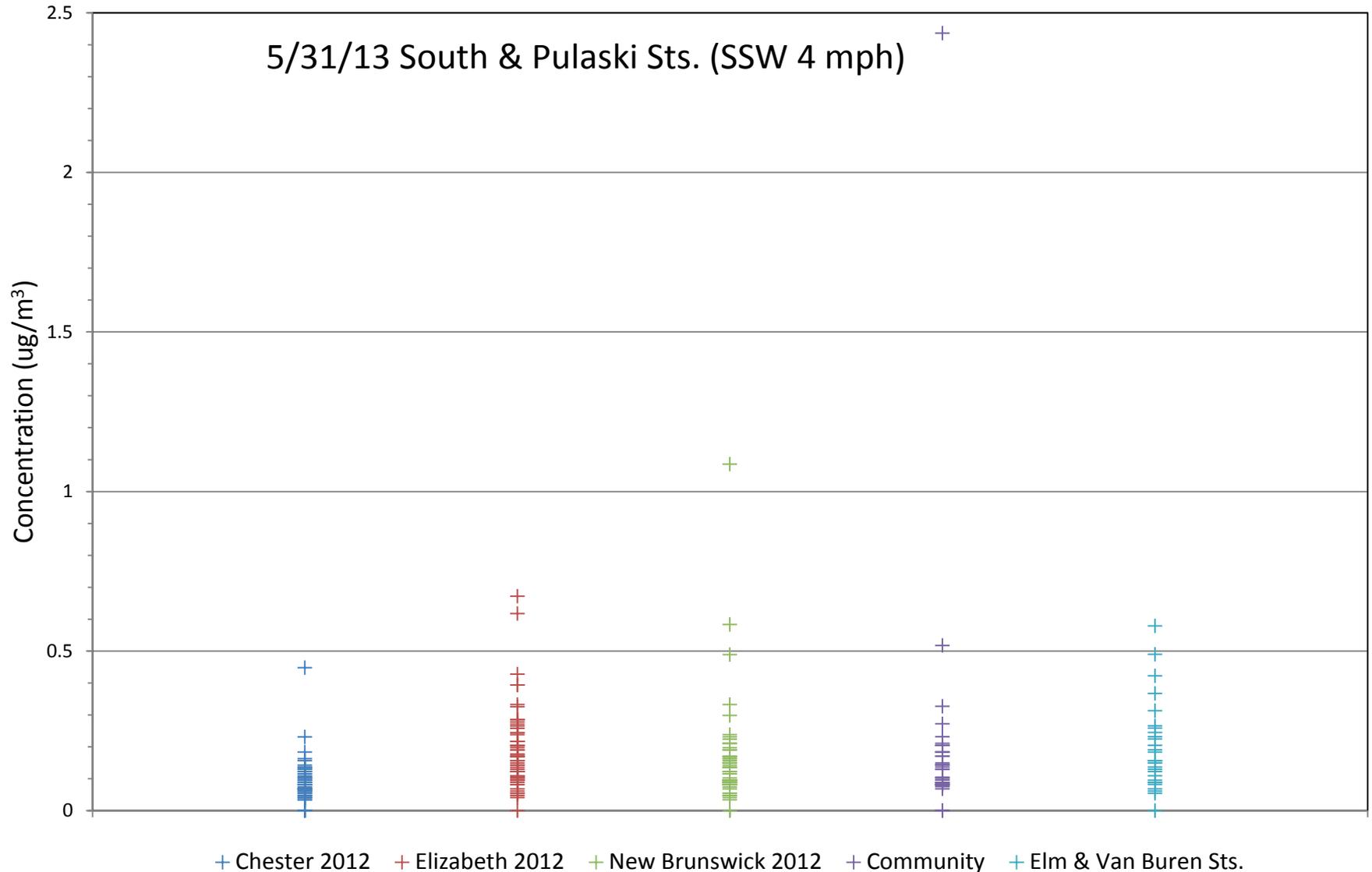
5/31/13 South & Pulaski Sts. (SSW 4 mph)



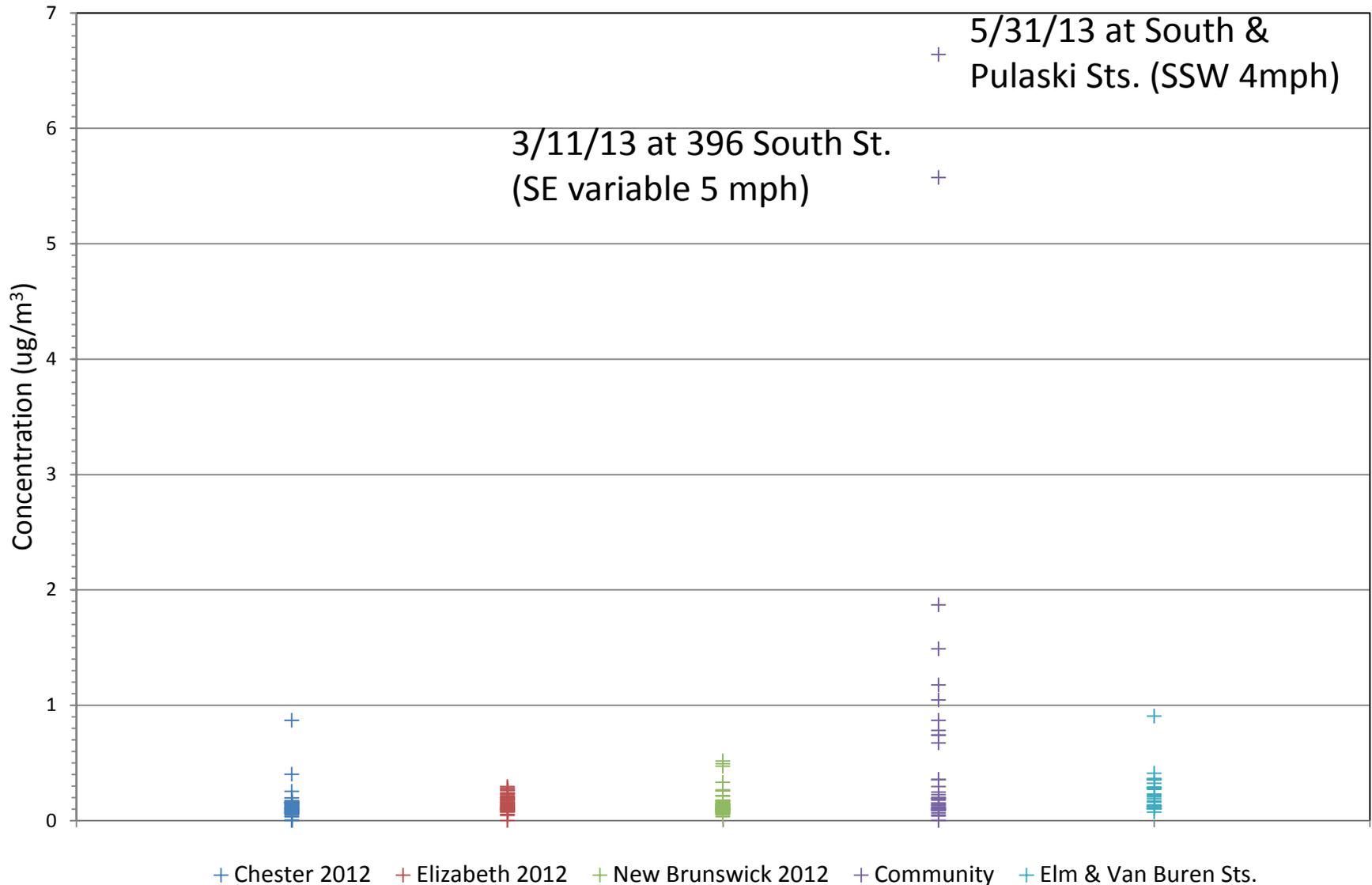
# CAMPIN - Styrene



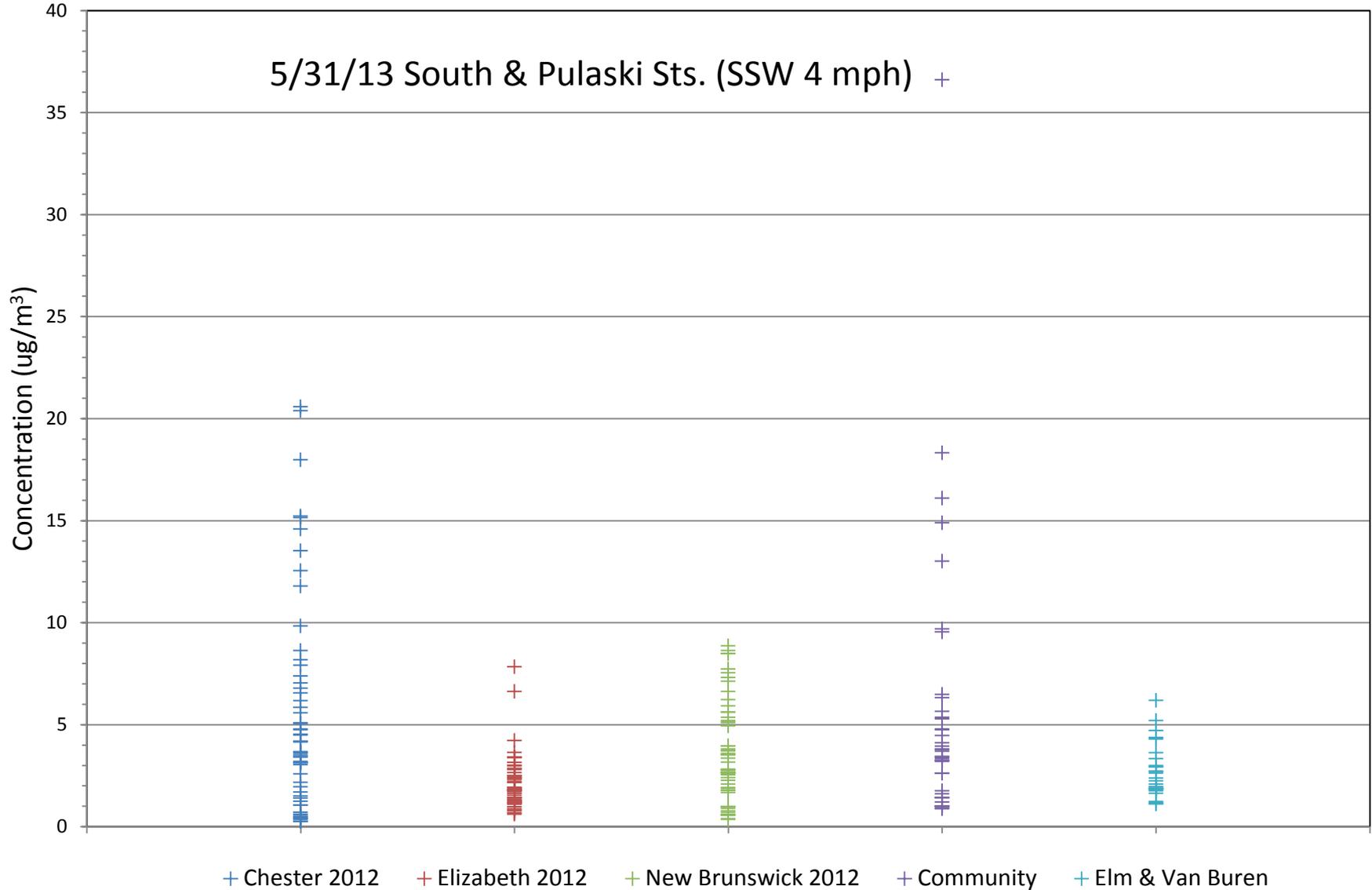
# CAMPIN - Tetrachloroethylene (PERC)



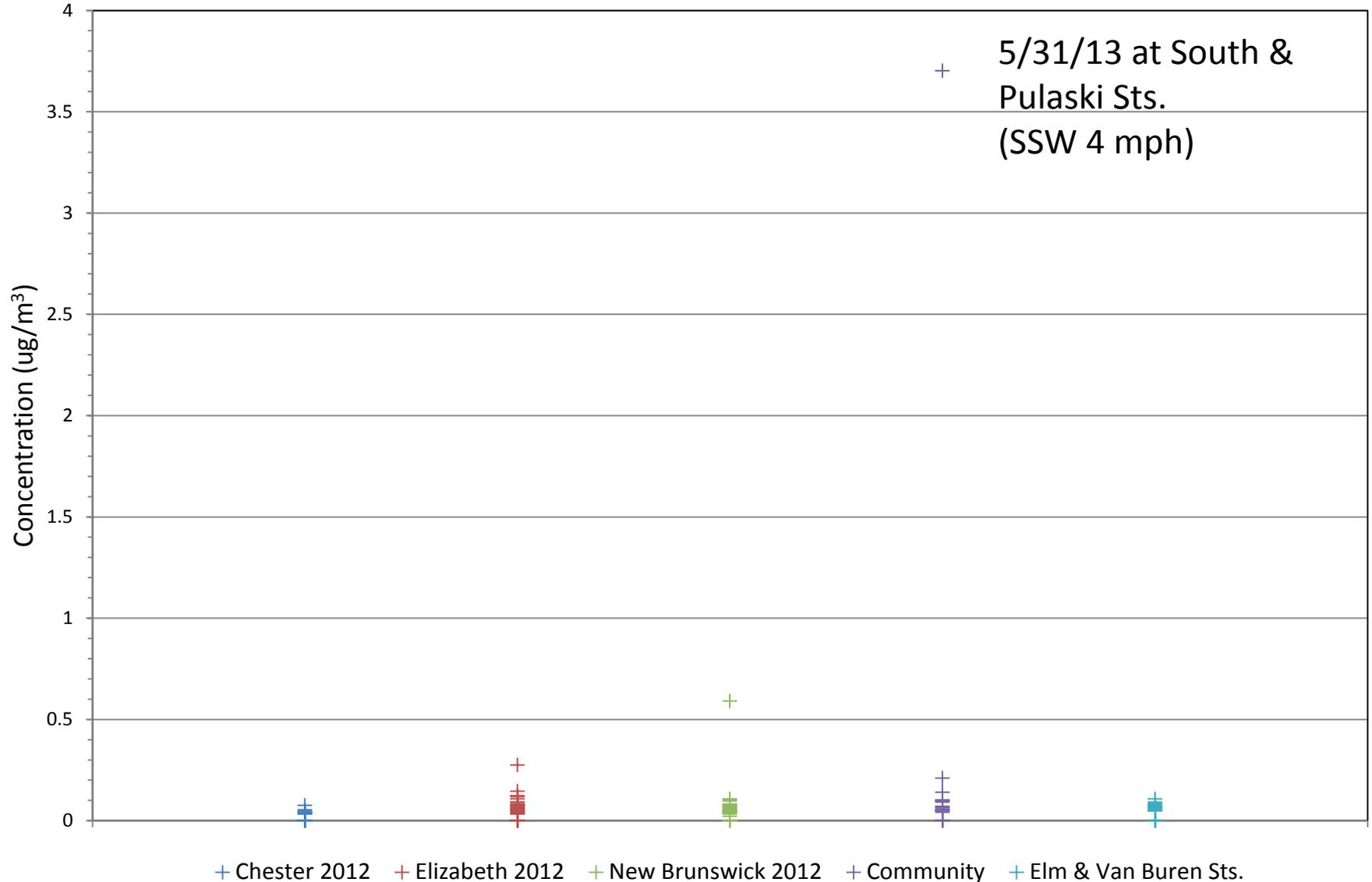
# CAMPIN - Methyl Isobutyl Ketone (MIBK)



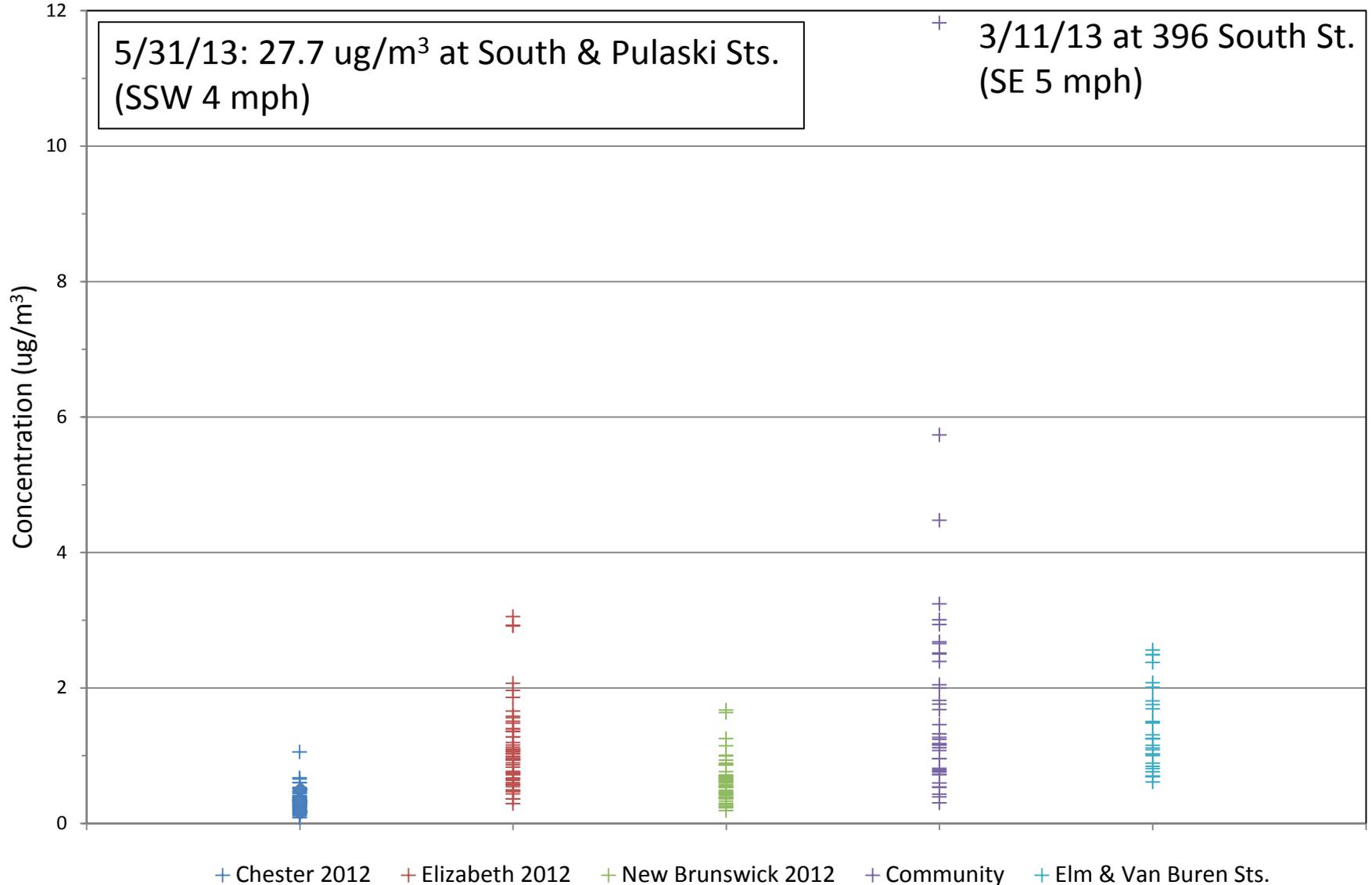
# CAMPIN - Toluene



# CAMPIN - Trichloroethylene



# CAMPIN - m,p-Xylenes



# How do we estimate the potential for health impacts?

- “Health benchmarks,” “reference exposure levels,” “reference concentrations”
- Terms used by some regulatory agencies to describe toxicity values they have developed to estimate the potential for human health impacts from specific chemicals.
- 17 chemicals sampled in CAMPIN have short-term health benchmarks (for exposures less than a year)
- **None of the pollutants measured during CAMPIN exceeded their short-term health benchmarks.**

# How does NJDEP determine the sources of air pollutants that are detected in a community?

- Check other monitoring sites' measurements for comparison
- Emissions Inventory Information
  - Release & Pollution Prevention Report
    - In 2012, 173 out of ~620 listed pollutants reported statewide
  - Major Sources (>25 TPY mixed or >10 TPY 1 HAPs)
    - Emissions statements (for 36 Toxic Air Pollutants)
  - Facility location/potential impact to area
    - Meteorology: wind speed, direction, precipitation
- Discussion with other NJDEP program areas
  - Known releases
  - Facilities with history of known releases
- Source/facility investigation



# What's Next?



- Final CAMPIN report
  - Review by NJDEP and USEPA management before release to public.
  - ~6-12 months.
- Possible follow-up?
  - Conduct more air sampling & further investigation to determine potential sources of air pollutants near the South Street area.

# Acknowledgements

- USEPA Region 2 Citizen Science Projects funded by FY12-PPG.
- USEPA Region 2: Mazeeda Khan, Avi Teitz.
- NY State Dept. of Environmental Conservation: Randi Walker & Jacqueline Perry.
- NJDEP staff (to name a few): Brad Bollen; Olga Boyko, M.S.; Amy Bowman; Leo Korn, Ph.D.; Lee Lippincott, Ph.D.; Jana Opperman; Riche Outlaw; Tanya Oznovich; Kerry Kirk-Pflugh; Charlie Pietarinen; Mark Rogoff; Erica Snyder, M.S.; Denise Warner; Ann Wolf and all the rest!
- Future City Inc., Michelle McBean-Doran
- AMMS & participating schools.
- Ironbound Community Corporation: Molly Greenberg; Ana Baptista, Ph.D.
- Central High School, Newark.
- New Jersey Environmental Justice Alliance.
- Rutgers University.
- And all the rest!

# ***Student Air Monitoring Project Lesson in Elizabeth (SAMPLE)***

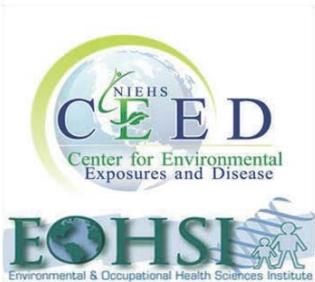
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- Contracted with RU for technical support
- Recruited about 10-15 students
- Students met ~1-2 day(s)/month from Oct. 2012- May 2013, in weekend/holiday program
- Learned about air pollution and human health, diesel emissions, sources in community
- Students monitored black carbon on 2 days, on a workday and a weekend, near and far from roadways
- Presented results at FCI's Environmental Day in April 2013 & at NJDEP in May 2013







# South Ward Air Monitoring Project (SWAM)



- Contracted with RU, who subcontracted with the New Jersey Environmental Justice Alliance (NJEJA)
- In-school project implemented over marking period at Central High School (Newark Public Schools).
  - South Ward, Newark, New Jersey
  - 28 9<sup>th</sup> grade students
  - Environmental justice component

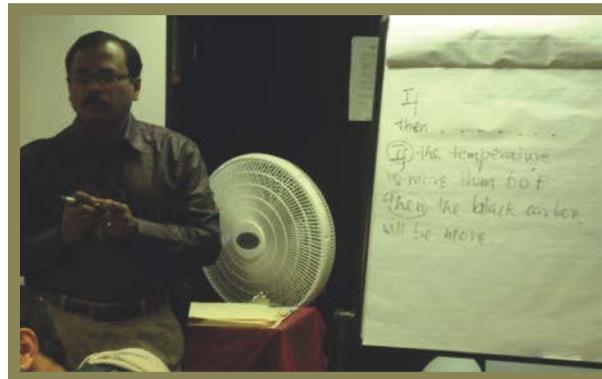
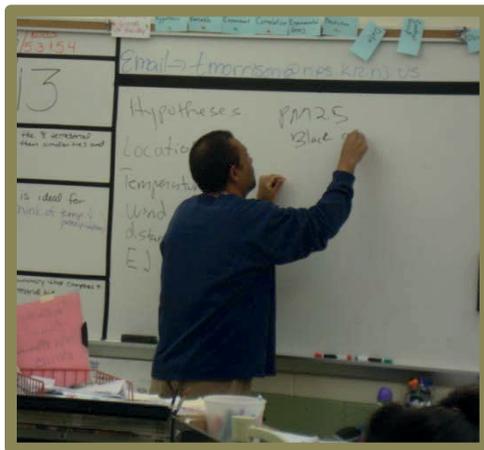


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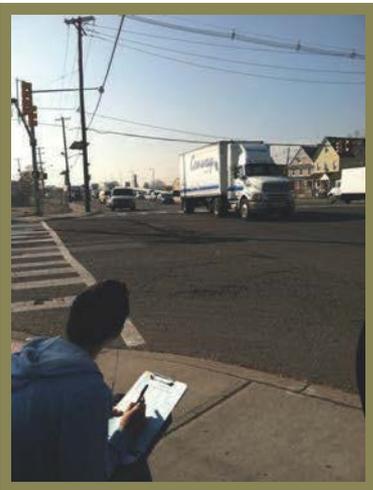
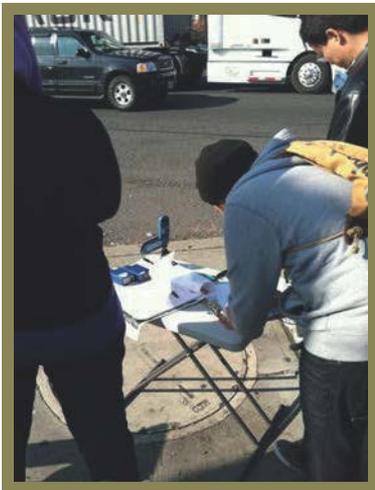
# SAMPLE & SWAM - Developing a Hypothesis

Students participated in the development of research questions and designs to characterize the impact of traffic on air pollution in their communities.



# SAMPLE - Field Sampling Days

- In Elizabeth, the SAMPLe students chose to take air samples from the intersection of Routes 1&9, a very heavily-trafficked intersection, near sources
- Simultaneously sampled air from a nearby park (low traffic area, far from sources) for comparison.
- On workdays and non-workdays



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# SWAM - Field Sampling Days

In Newark, the SWAM students performed air sampling at three locations:

- Springfield Avenue, a highly-trafficked area
- Irvine Turner Blvd, a moderately-trafficked area
- Nat Turner Park, a low-trafficked area



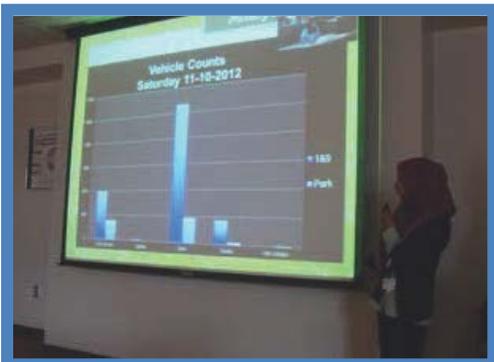
# SAMPLE & SWAM - Data Analysis

- After sampling, the students organized, QA/QC'd and performed data analysis
- Students assessed the impact of location, truck traffic, vehicle type counts, day of week and meteorological factors on the black carbon levels in their communities.



# SAMPLE & SWAM - Presentations

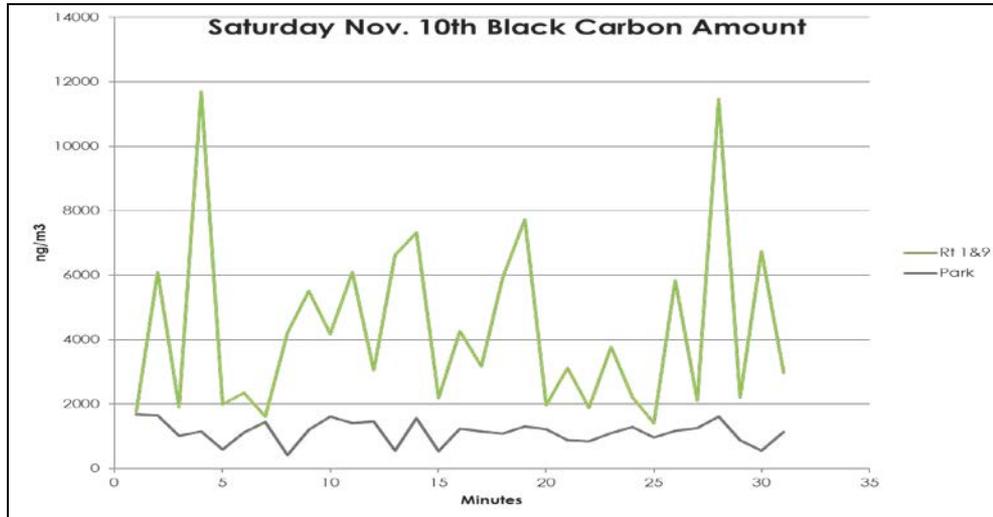
- The students prepared presentations and presented at the annual meeting of the Tri-State Chapter of the International Society of Exposure Science at the Rutgers University.
- SAMPLE students also presented their results to the NJDEP Commissioner & staff and participated in a career session with NJDEP staff.



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# Example of SAMPLE Data Analyses/Results

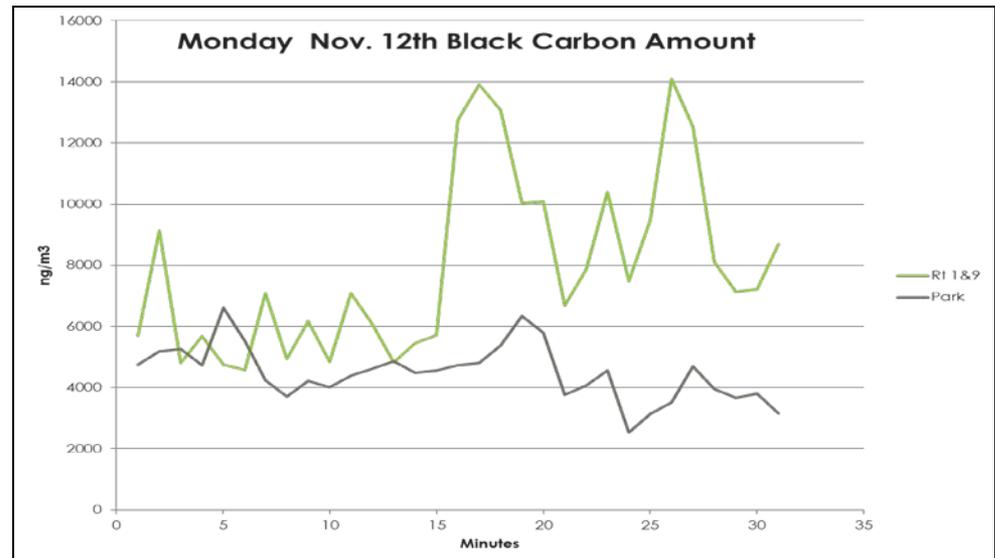


**Mean at Rt. 1&9:  
4306 ng/m<sup>3</sup>**

**Mean at Park:  
1133 ng/m<sup>3</sup>**

**Mean at Rt. 1&9:  
7948 ng/m<sup>3</sup>**

**Mean at Park:  
4485 ng/m<sup>3</sup>**



# SAMPLE & SWAM - Project Summaries

Through participation in these air monitoring projects, the students increased their awareness of air pollution and air monitoring; developed an interest in environmental science/public health; and learned new skills in statistics, excel, mapping, making presentations and public speaking.



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# Status Report

## Citizen Air Monitoring Project

### in Ironbound, Newark (CAMPIN)

**May 6, 2014**

Linda Bonanno, Ph.D., Olga Boyko, M.S.,

NJDEP, DAQ, BTS, AQEv

Ironbound Community Corporation



**Ironbound**  
**COMMUNITY**  
**CORPORATION**

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# What's Next?



- Final CAMPIN report
  - Review by NJDEP and USEPA management before release to public.
  - ~6-12 months.
- Possible follow-up?
  - Conduct more air sampling & further investigation to determine potential sources of air pollutants near the South Street area.