Citizen Science: Connecting, Technology & Communication

MARAMA & NESCAUM

Dec 11, 2014

Linda Bonanno, Ph.D.

(609) 984-9480

linda.bonanno@dep.nj.gov

New Jersey Department of Environmental Protection

Division of Air Quality

draft and deliberative do not cite or quote

2012-2014 NJDEP CS Air Projects

- Student Air Monitoring Project Lesson in Elizabeth (**SAMPLE**)
  - Future City Inc., Elizabeth (FCI)
- South Ward Air Monitoring (**SWAM**)
  - Central High School, Newark
  - Contract with academic institution and they subcontracted to community group
- Student Air Monitoring Project (**SAMP**)
  - Contract with consultant
  - 5 schools (2 in Mercer County, 3 Paterson)
    - Needed established NJDEP personal relationships to set up schools to participate
- Citizen Air Monitoring in Ironbound, Newark (**CAMPIN**)
  - Ironbound Community Corporation (ICC)

draft and deliberative do not cite or quote

2014-2016 NJDEP CS Air Projects

- Student Monitoring Ozone Ground level (SMOG)
  - Partner with Future City Inc. (FCI)
    - Focus on student participation/peer to peer
    - Continue to build capacity for the community
- Follow up Air Sampling Toxics During Odors Ironbound Newark (FASTDOIN)
  - Partner with Ironbound Community Corp (ICC)
    - Focus on odors and sampling strategy
    - Continue to build capacity for the community

draft and deliberative do not cite or quote

3

Overall Citizen Science Project Goals

- Test various methods for community air pollution monitoring:
  - Engaging/organizing community members
  - Monitoring methods
  - Viability of having community members take air samples
  - Different ways of implementing projects
  - Education and awareness
  - Determine how to use data effectively

draft and deliberative do not cite or quote

4

Citizen Science Projects

- Importance of teamwork
- Issues surrounding air pollution
- Local geographic area of study
- Instruction on instrumentation
- Data analysis
- Mapping
- Emphasize during student projects
  - Scientific method/generating hypotheses
  - Presentation preparation

draft and deliberative do not cite or quote

5

Connecting to Communities…

Leverage Existing Resources

Connect, Build & Maintain Relationships:

Build off relationships developed by other NJDEP program areas:

NJDEDP ↔ Community Groups ↔ Members

- Working with established community groups
- Resources allocated towards many communities vs. building capacity in few?

Communicate Effectively:

1. Roles, responsibilities & expectations
2. Limitations (funding, technology, use of data)
3. Provide timelines (tasks, meetings)

draft and deliberative do not cite or quote

6

Community Groups Want to Partner with Department

- Direct line of communication to NJDEP for community group
- Resources, funding, technical expertise, staff, data analysis etc.
- Opportunity to express community concerns outside project scope
- Ability to leverage other NJDEP resources

draft and deliberative do not cite or quote

7

Some Things To Consider

- Community concerns
  - Trucks, stationary sources? Odors? Education? Ppportunities, etc.
- Community group's core vision
  - Outreach/education, engagement/empowerment, advocacy, environmental justice…
  - Science project, leadership skills, collect data for 'body of evidence' approach…
- Application
  - education/opportunity, odor/ source characterization, comparison air quality to other areas, science, empowerment, sustainable tools, etc.
- Individual community members' interest
  - It smells outside my door, data for science fair, transferable technological tools, (excel, meteorological impacts, etc.)

draft and deliberative do not cite or quote

8

Provide Support to Community Group/Individuals

- Financial support to community group
- Technical expertise/advice
- Food/minimal stipends for participating
- Awareness of cultural differences (e.g., religious observances, food restrictions)
- Instrumentation,
  - Sustainability, set-up, ease of use
  - Analysis
  - Support materials for sampling (e.g., education, COC, sampling maps)

draft and deliberative do not cite or quote

Develop, Maintain Relationships within the NJDEP & Funding Agency

- Partner with many NJDEP programs (Communication, Environmental Justice, Science, Air Monitoring, Quality Assurance, etc.)
- Maintain relationship with funding agency program areas, e.g., USEPA Region 2

draft and deliberative do not cite or quote

Keep in Mind…..

Flexibility change course…

Where you think you are headed may not be where you end up, and that's ok

Keep Communicating!

draft and deliberative do not cite or quote

Technology

- Community needs
- NJDEP concerns
- Ease of use, logistics, geographic constraints

(Photo courtesy of NYSDEC)

draft and deliberative do not cite or quote

MicroAeth® Hand Held Aetholometers for Black Carbon Measurements

- Used during SAMPLE project and will be for SAMP (http://www.nj.gov/dep/seeds/airqed/SAMP/)
- Extreme +/- peaks in output with rapid change in temperature and relative humidity (Cai et al., 2014)
- May take end users couple days to register with MicroAeth on line to access data,
- Need to keep unit stable and horizontal for best output (e.g., set on table)
- Initially hard to turn on and off, problem fixed

~1 Hour Canister Sampling

VOC/TO-15 by ERG during CAMPIN & FASTDOIN

- Fitting on sampling inlet becomes worn with use
- Knob can be hard to turn
- Doesn't sample exactly 1 hour
- Need device (e.g., tripod, metal stool) to hold canister for sampling
- Cumbersome to transport
- Suggested GPS compatibility for more accurate locational information

Ozone Handheld Units for SMOG

draft and deliberative do not cite or quote

15

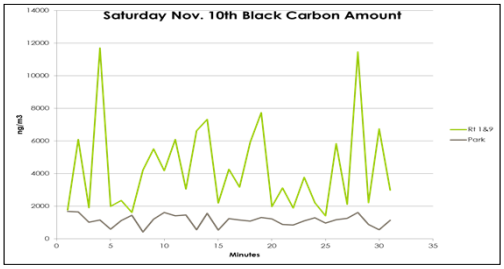
Ozone Stationary Monitor for SMOG

- Photo courtesy Global Ozone Project

draft and deliberative do not cite or quote

16

Example of SAMPLE Data Analyses/Results

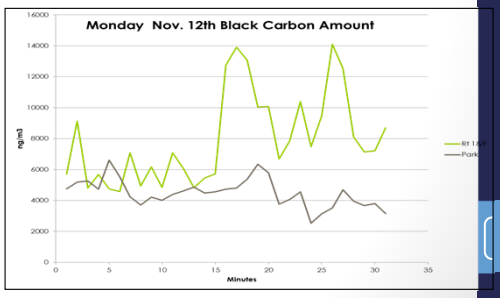


Mean at Rt. 1&9: 4306 ng/m³

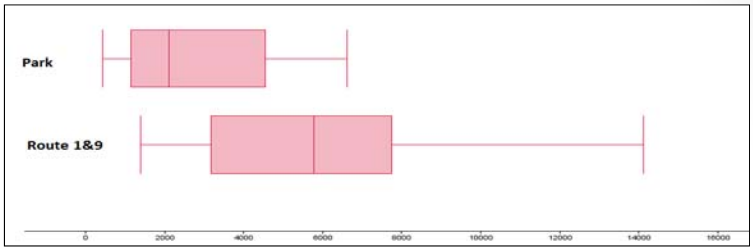
Mean at Park: 1133 ng/m³

Mean at Rt. 1&9: 7948 ng/m³

Mean at Park: 4485 ng/m³



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.

draft and deliberative do not cite or quote

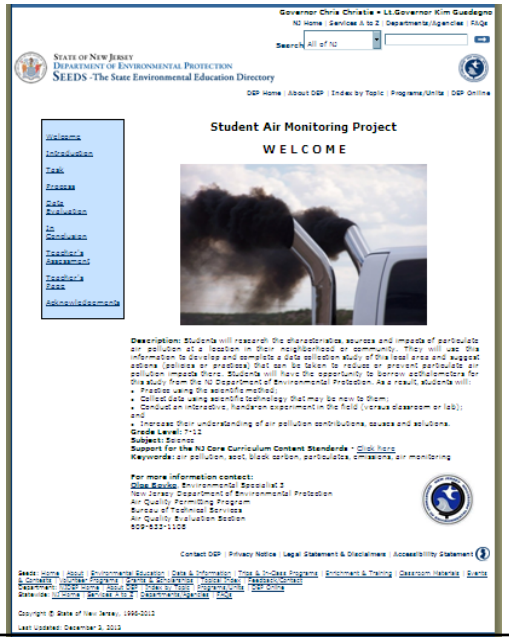
18

SAMPLE Presentation Day at NJDEP

draft and deliberative do not cite or quote

19

(http://www.nj.gov/dep/seeds/airqed/SAMP/)



draft and deliberative do not cite or quote

20

Citizen Air Monitoring In Ironbound Newark (CAMPIN)

- Community members concerned about multiple sources and odors in their community
- Worked closely with community group to educate and inform on technological limitations.
- Community group instrumental in helping to develop appropriate sampling materials

draft and deliberative do not cite or quote

21

Developed through Collaboration between NJDEP, ICC

Chain of Custody Record
Citizen Air Monitoring Project in Ironbound Newark (CAMPIN)

#2 Note to resident:
Please take sample by 12/20 (date)
Please complete shaded box, #4.

Sampling Tips!

*Immediately after the canister is opened, the reading of the pressure gauge (black number) should be around 28-30. If the pressure reading is not in the 28-30, call Molly at ICC (973)817-7013 x215 for instructions.

* Watch the gauge during sampling. When gauge is between 5-6, close the canister. This usually takes between 30 minutes to 1 hour.

*After sampling is done, close the canister valve by turning green knob clockwise. Don't over-tighten.

#2 To be filled out by Eastern Research Group, Inc. — ERG
Canister # 121037 TO-15 Analysis
Lab Initial Can Pressure ("Hg) 29.9
Date Can Cleaned 12-3-12
Cleaning Batch # 1-1969
CCNJ
601 Keystone Park Drive, Suite 700
Morrisville, NC 27560

#3 FILLED OUT BY AN ICC MEMBER

CAN RECEIVED AT ICC BY	DATE	TIME	SAMPLING CANE INSTALLED BY	DATE	TIME
12/6/2012 Ana Segarra	12/6/12	3:00	Molly Greenberg	12/14/12	10:20
DISTRIBUTED TO A RESIDENT BY	DATE	TIME			
Molly Greenberg	12/14/12	2:00			

#4 TO BE FILLED OUT BY THE RESIDENT WHO COLLECTS THE SAMPLE - Be sure to watch pressure gauge, when between 5-6 turn off valve and note sampling time. It may be more/less than 1 hour. Be sure to check that the initial pressure in the canister is the lab initial pressure listed at the top of this sheet. If different, canister has leaked and should be replaced.

Name of PERSON COLLECTING SAMPLE: Leonard Thomas
SAMPLING LOCATION (Address): NE corner of Roanoke Ave & Hawkins St.
Specific descriptions about the sampling location. Please list any sources of air pollution-related activities or unusual activities nearby.
High truck traffic area, bordering industrial area
Wind NE @ 20-25 mph

DATE	START TIME	INITIAL PRESSURE	END TIME	FINAL PRESSURE
12/14/12	2:30 PM	-30	3:24	6

#5 FILLED OUT BY AN ICC MEMBER
RETURNED TO ICC BY Leonard Thomas DATE 12/14/12 TIME 4:00

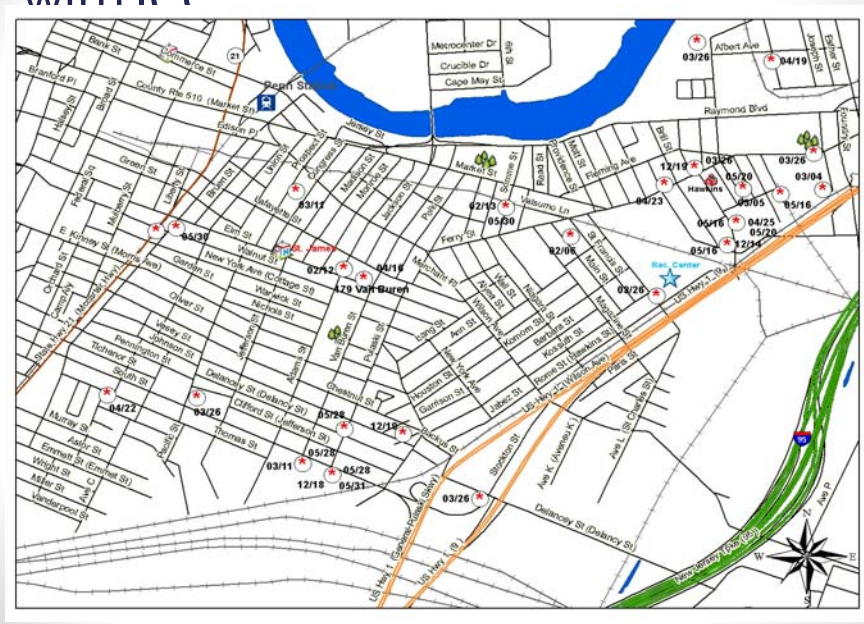
#6 ERG LAB USE ONLY

RECEIVED FOR LABORATORY	DATE	TIME	AIRBILL NO.	LIMS ID
OPENED BY	DATE 12/20/12	TIME 10:35	CAN PRESSURE ("Hg) 4.5"	CONDITION Good

COMMENTS:

LIMS ID: 2122014-01

Sampling Map CAMPIN Developed with ICC



draft and deliberative do not cite or quote

23

CAMPIN Sampling Brochure

The Steps
Must take the sample within 2 weeks of getting canister.
Follow each step carefully to capture a good air sample.

1. Check to make sure that the canister valve is fully closed. The green knob should be turned completely clockwise. If it's not, call the office for a replacement canister.
2. Remove the aluminum foil from around the end of the sampling cane/rain shield.
3. RECORD THE START TIME ON THE SUPPLIED CHAIN OF CUSTODY.
4. Open the canister valve completely by turning the green knob counterclockwise a little past a full turn. Be careful – do not turn the green knob so much that it falls off.
5. Record the pressure from the gauge on the supplied Chain of Custody. Write down the black number that is on the outside of the circle. It should be between 29-30. If not, call Molly for replacement canister.
6. Check that the pressure matches what is on the Chain of Custody.
7. Wait with the canister for one hour. Watch the pressure gauge during that hour.
8. When gauge is between 5-6, close the canister. This can happen before one hour is up.
9. Record the pressure from the gauge, and close the canister valve by turning the green knob clockwise. Don't over-tighten.
10. RECORD THE STOP TIME ON THE SUPPLIED CHAIN OF CUSTODY.
11. Replace the aluminum foil around the end of the sampling cane.
12. Double check to make sure that Box 4 is completely filled out.
13. Place the Chain of Custody and map in the envelope.
14. Call Molly Greenberg of Ironbound Community Corporation (973) 817-7013 x215 to arrange for pickup or delivery of the sampling canister.

Citizen Air Monitoring Project in Ironbound Newark (CAMPIN)

Read this pamphlet completely before you start.
These canisters are for outdoor air sampling only.
Do not use them indoors!

Are You Ready to Sample?

- ❑ Have you read this pamphlet completely?
- ❑ Have you seen the training video?
- ❑ Do you have the sampling canister, step stool, map and Chain of Custody?
- ❑ Do you have a pen and clipboard to write on?
- ❑ Do you have a watch for keeping track of and recording time?
- ❑ Is it going to be a dry day? Is the wind coming from the right direction? Is the day too windy?

DO NOT SAMPLE DURING A RAINFALL.

New Jersey Department of Environmental Protection
Division of Air Quality and the Office of Science

draft and deliberative do not cite or quote

24

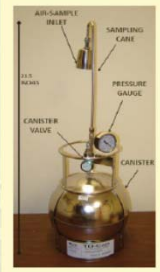
CAMPIN Sampling Brochure

The Canister

The canister comes fully assembled. Instructions, Chain of Custody, map and other tips are included. Collect your air sample as soon as possible after receiving the canister so that the sample is returned to the laboratory by the expiration date shown on the canister.

You may be asked to collect a second sample using a second canister as part of our quality assurance and control process. Collect this second canister sample at the same time and at the same place as your first canister sample.

Do not remove the bar code or serial number labels from the canisters. Do not mark the canister or attach anything to it.



Once You Get the Canister:

- Store the canister away from lawn mowers, containers of pesticides or any open fire.
- Do not store it in your car or truck.
- Avoid getting any material such as lotion, perfume, oil, grease, herbicides or pesticides on the outside of the canister.

Handle the Canister with Care:

- The canister weighs about 5 to 6 pounds and can break if dropped or knocked against a solid object.
- Protect the thin hook at the top (sampling cane) from being bumped, and keep track of the aluminum foil at the end of the stem that you remove just before sampling.
- Consider taking a buddy with you to help with the canister and note taking, especially if you are taking two canisters on the same outing.

Paperwork and Reporting

You might have many samples to collect at different times or different spots around the neighborhood. Each canister has its own paperwork. Be prepared to complete the paperwork for each canister.

- Mark the exact sampling location on the map included in your sampling canister paperwork.
- If you decide to collect a sample at a location not on the map, record that location, including street name and number, cross streets, etc.
- Consider sending photos of the sampling site. These help us better understand the situation. Observe and record traffic congestion, idling vehicles, lawn mowing, and painting in your sampling area. Do not sample near a fire. These activities will interfere with what you want to capture.
- Remember to complete the Field Log.

Is Today the Day to Sample?

Use your judgement. Odors don't have to be the "worst ever" to get a good sample.

- Make sure wind is from the right direction.
- No wind or light steady winds are OK. Avoid strong winds.

Equipment Delivery:

Call Molly Greenberg of Ironbound Community Corporation as soon as sampling is done to make arrangements to return the canister. All samples must be analyzed by the laboratory within 30 days of the cleaning date.

Questions?
Contact Molly Greenberg
(973) 817-7013 x215
mgreenberg@ironboundcc.org

Setting Up and Taking the Sample

Your job is important. Remember to carefully follow the steps outlined on the back.

The canisters come prepared to take the desired outdoor air sample. The canisters work by having less pressure inside than the pressure of the outside air, so they should be opened ONLY to collect the sample. Once the aluminum foil is removed from the stem and the valve is opened, outside air enters the canister. This outside air is the sample.

It takes about one hour to collect a good sample. You must stay with the canister for the entire time and record the data.

You will be given a step stool and bungee cord to lift the canister off the ground and secure the canister to the stool.

- Place the sampling canister securely on the top step of stool.
- Secure canister on stool with bungee cord.
- Face the wind and place the canister in front of you to collect the sample.
- Nobody should be smoking anywhere in the vicinity of the sampling canister while sample is being collected.

If you accidentally open the canister, do not use it.

Call Molly Greenberg of Ironbound Community Corporation at (973) 817-7013 x215 and a replacement canister will be provided.

draft and deliberative do not cite or quote

25

Interpreting Data / Communicating Results for CAMPIN

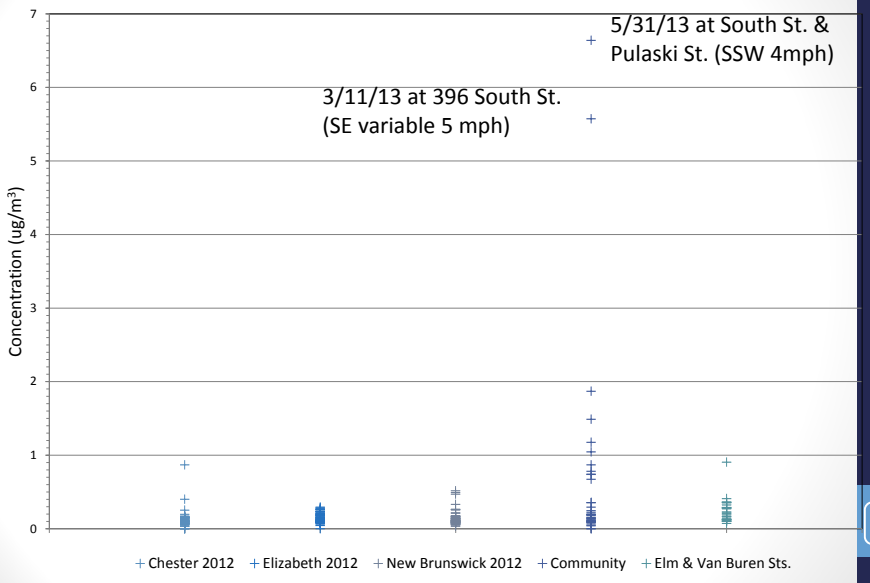
CAMPIN Air Sampling Results

- Compared measured concentrations to NJDEP's permanent air monitoring stations
- Local Samples @ ICC building taken on same frequency and duration as NJDEP monitors
  - Chester (Morris Co.) ~ rural area
  - Elizabeth (Union Co.) ~ mobile source area
  - New Brunswick (Middlesex Co.) ~ suburban area
- Community samples taken around Ironbound by community members at different places, days, times for approximately 1 hour.

draft and deliberative do not cite or quote

26

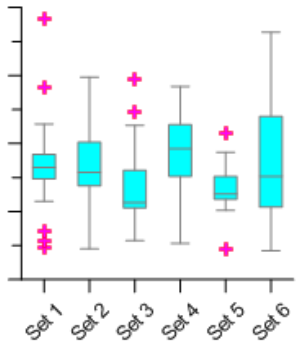
CAMPIN - Methyl Isobutyl Ketone (MIBK)



draft and deliberative do not cite or quote

27

CAMPIN Data - Box & Whisker Plots

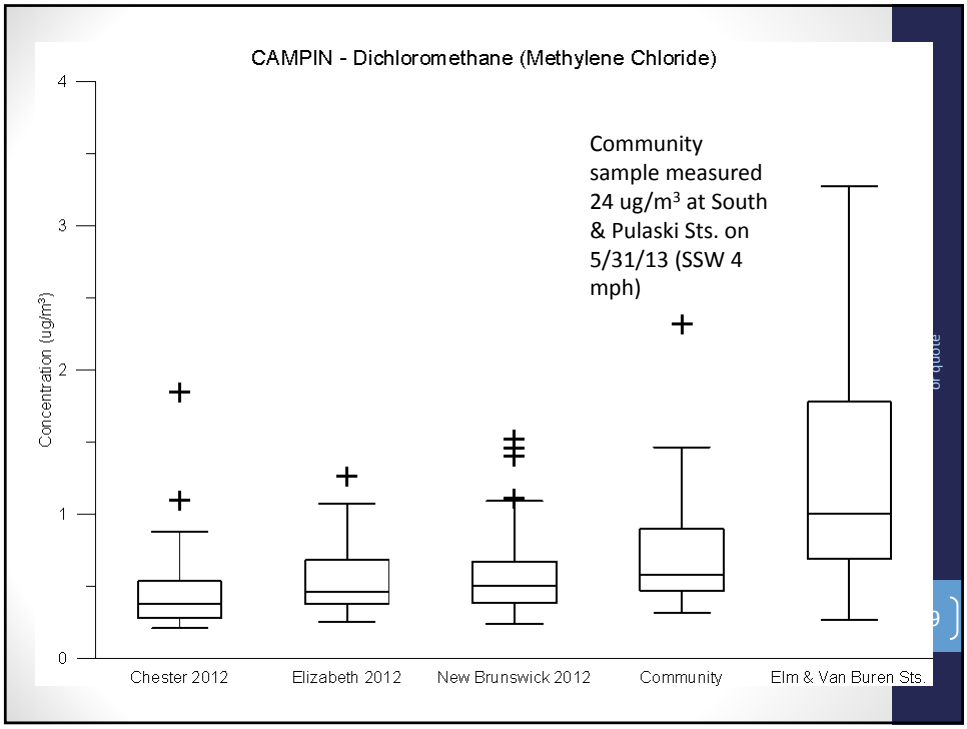


Box-Whisker plots show minimum, maximum, median, lower quartile (25th percentile), and upper quartile (75th percentile) information for groups of data.

The "+" shows data that is outside the range expected, based on the software's interpretation of the rest of the data.

draft and deliberative do not cite or quote

28



Successful Projects

- Listen to community concerns/limitations
- Communicate
  - Limitations of resources & technology
  - Scheduled meetings
    - e.g. monthly calls with key partners
    - Mid-project communication of interim results
- Flexibility!

draft and deliberative do not cite or quote

30

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; Amy Bowman; Leo Korn, Ph.D.; Lee Lippincott, Ph.D.; Jana Opperman; Riche Outlaw; Tanya Oznowich; Kerry Kirk-Pflugh; Erin Brodel; Charlie Pietarinen; Mark Rogoff; Erica Snyder; 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.
- Global Ozone Project
- 2B Technologies Inc.
- And all the rest!

draft and deliberative do not cite or quote