Harlem Ecological Summary and Solutions

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Introduction

With over 8 million people and boasting the Nation's largest regional economy, New York City should be an example of sustainability in the world. However, quite the opposite is true. When we consider the elevated levels of Carbon Dioxide and Particulate Matter in the air or the low levels of Oxygen in the Harlem River it becomes evident the somewhere along the line the people of New York got lost in their frantic pursuit of money and turned their back on their health. Harlem in particular has been targeted the worst.

Introduction

For years now asthma rates in Harlem have been increasing alarmingly because of the high levels of Particulate Matter produced by the same vehicles that bring us our goods (We Act, 2009). Our children are being born with lower I.Q.s because of it too (Hoepner, et. al., 2009). In a sense, we are poisoning ourselves in order to obtain the things we need. But are there no other alternatives that can bring back the healthy air our community needs? Can't we stop flushing contaminants into our Rivers and blocking them off from our use in order to get what we need to live? The answer is YES.

Introduction

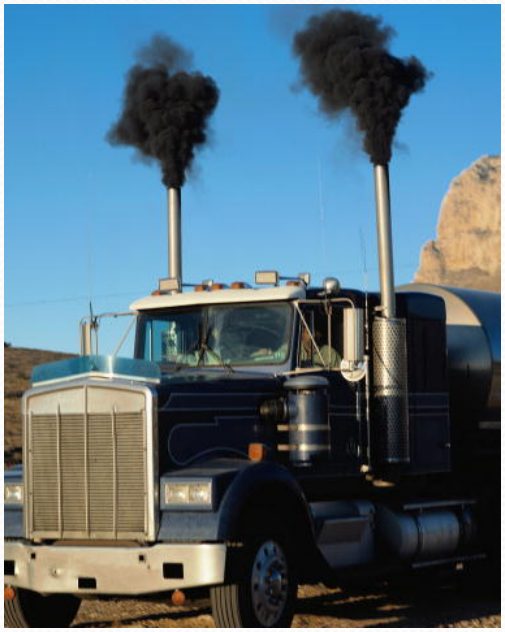
Yes - There are things we can do but it will take a lot of good choices and the will to change the minds of those who are set in their ways. This project will propose some solutions that are revolutionary. But if we're indeed the greatest city of the world then no idea can be too big or too difficult to prevent us from pulling together and changing it into the healthiest city on Earth.

Background on Particulate Matter (EPA, 2009)

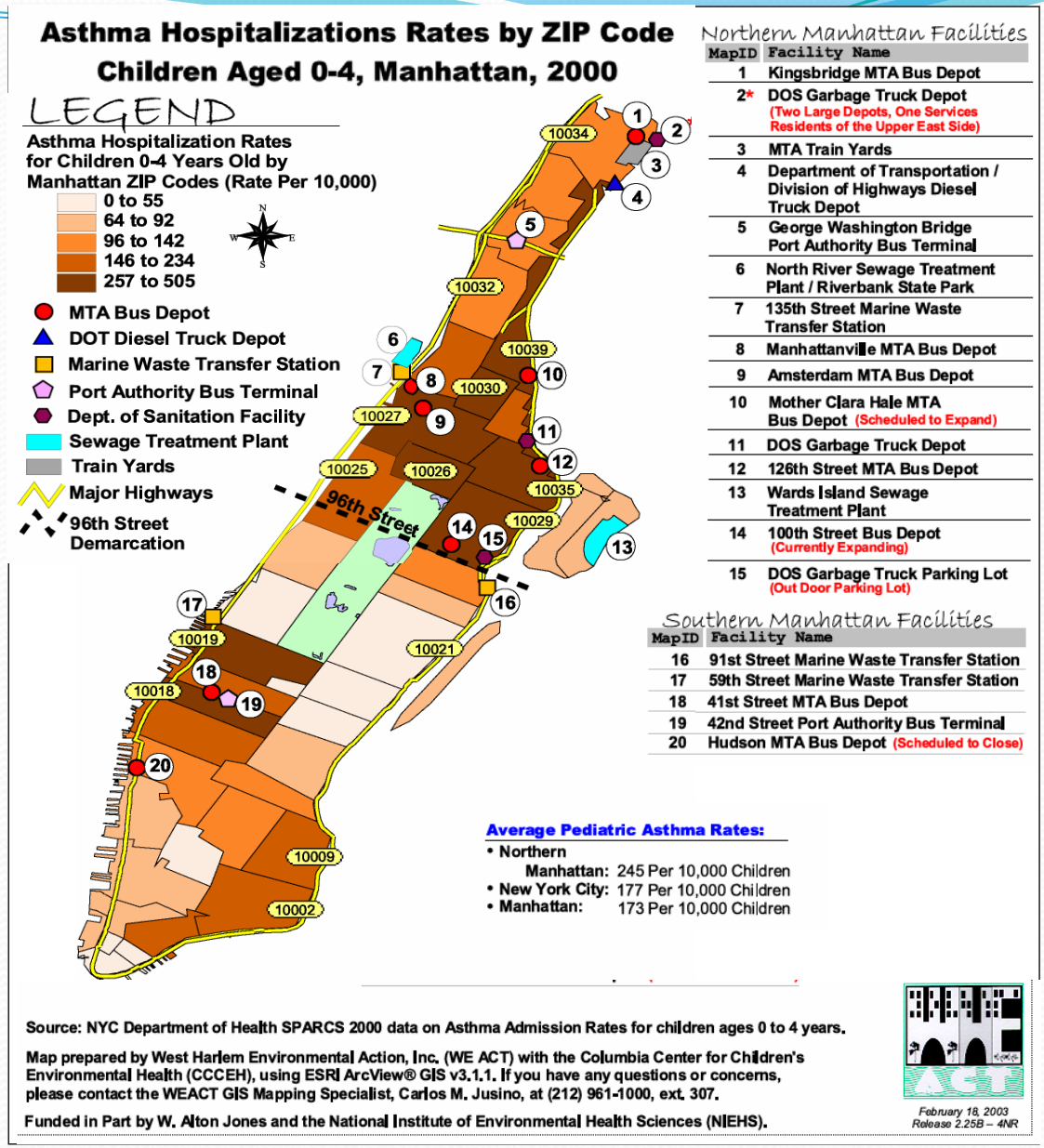
- Particulate Matter are solid and liquid particles suspended in the air. Most are hazardous. They can contain for instance dust, pollen, soot, smoke, liquid droplets, and carcinogenic chemicals.
- Particles that are smaller than 10 microns will impact human health – in particular their respiratory system.
- PM smaller than 3 microns cause cancer because they penetrate the body, its cells, and nuclei damaging the DNA.

Background on Particulate Matter (EPA, 2009)

- PM smaller than 3 microns is a byproduct of diesel engines found on the very trucks that deliver our goods.
- Most places in Harlem have a high incidence of PM proven to be the cause of at least 1 cancer patient out of every 10,000 inhabitants.



- Notice the roads in yellow.
- Notice the bus depots in red.
- Now notice the darker shades for incidence of asthma in the order of 257 – 505 children between the ages of 0-4 per zip code.
- (We Act, 2009)



Air Quality & Cancer (EPA, 2009)

Cancer Risks / Noncancer Risks

- No risk (tract unpopulated) / HI<1
- <25 in a million / HI 1-2
- 25-50 in a million / HI 2-3
- 50-75 in a million / HI 3-4
- 75-100 in a million / HI 4-5
- >100 in a million / HI > 5

Other sources of PM (EPA, 2009).

Name of Chemical	Percentage of Total Pollution in Area	Everyday Uses	Diseases It May Lead To
Benzene	**35%**	**Make plastic, nylon, pesticide**	**Leukemia, Hodgkin Disease**
Naphthalene	**12%**	**Major Ingredient in Moth Balls**	**Flu, skin discoloration, oliguria**
Butadiene	**12%**	**Make rubber**	**Liver disease**
Carbon Tetrachloride	**7%**	**Fire Extinguishers, Lava lamps**	**Liver, Kidney, and Central Nervous System Malfunctions**
Acetaldehyde	**5%**	**Tobacco (CIGARETTES)**	**Respiratory Malfunction**
Arsine	**3%**		**Kidney failure**
Chromium	**3%**	**Metal car parts**	**Liver or Kidney Disease**

Background on Dissolved Oxygen (Ministry for the Environment, 2009).

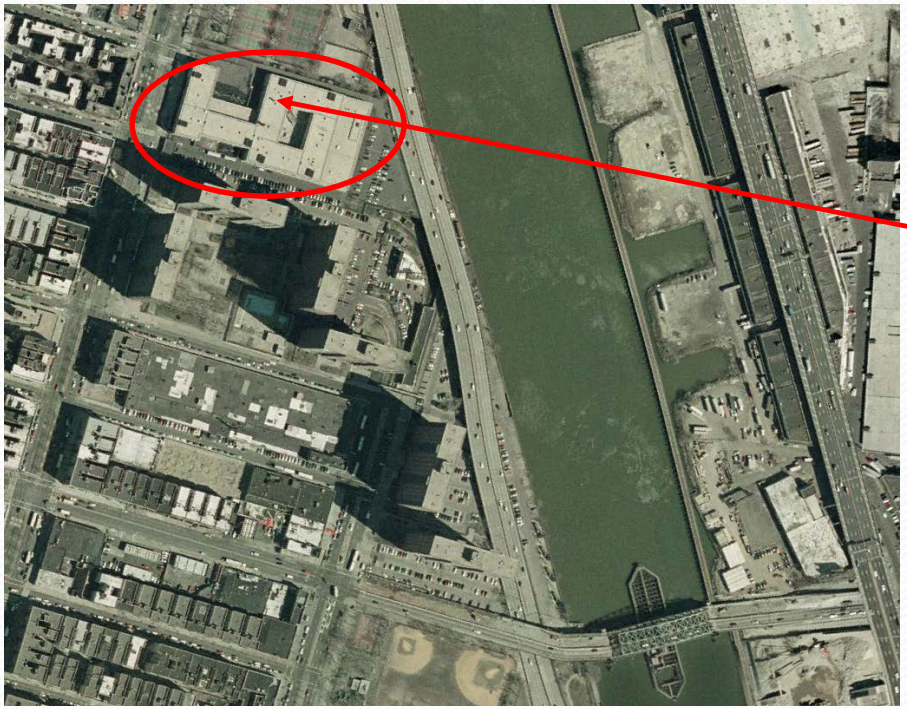
- Dissolved Oxygen (DO) is an indicator of the health of a fresh water system.
- Oxygen is a gas produced by plants during photosynthesis.
- It is required by all organisms that use organic compounds as a source of energy including plants and animals.
- When the levels fall below approx. 2.10 mg/L (30%) in the water the environment is said to be anoxic.

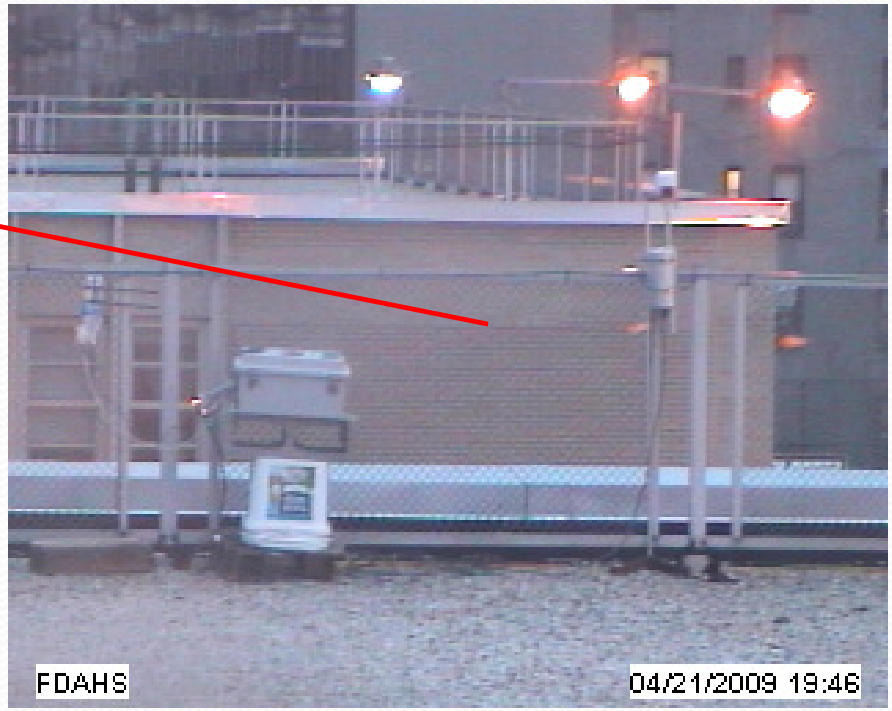
Background on Dissolved Oxygen

- Anoxic environments cause most major forms of life to die off very quickly only allowing very simple forms of life to live like some species of anaerobic worms and microorganisms.
- These organisms produce waste that makes the water smell and makes it harmful for people to be around.
- Oxygen depletion is commonly caused by organic pollutants breaking down in waterways, elevated water temperatures or night-time respiration by dense algal blooms in nutrient-rich waters.

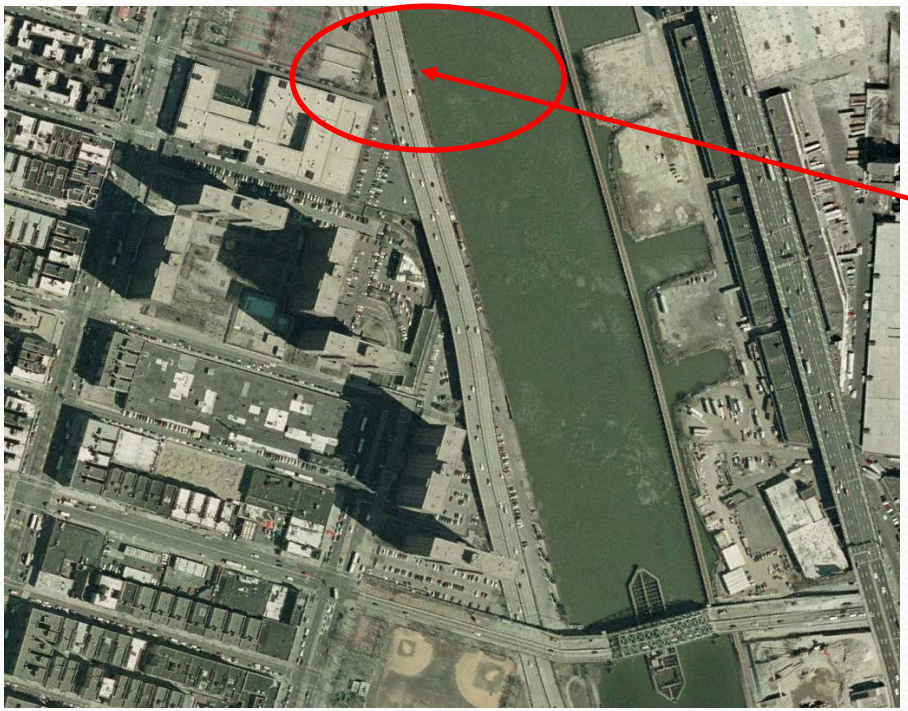
SCIENTIFIC PROBLEM
What are the environmental conditions in Harlem and what improvements can we suggest?
HYPOTHESIS
The Harlem Atmosphere and River are too contaminated to sustain healthy living organisms.
OBJECTIVES
Determine the physical chemical parameters of the Harlem River.
Determine the effect of air quality on the surrounding community's health.
Propose improvements.

Study Area: Frederick Douglass Academy

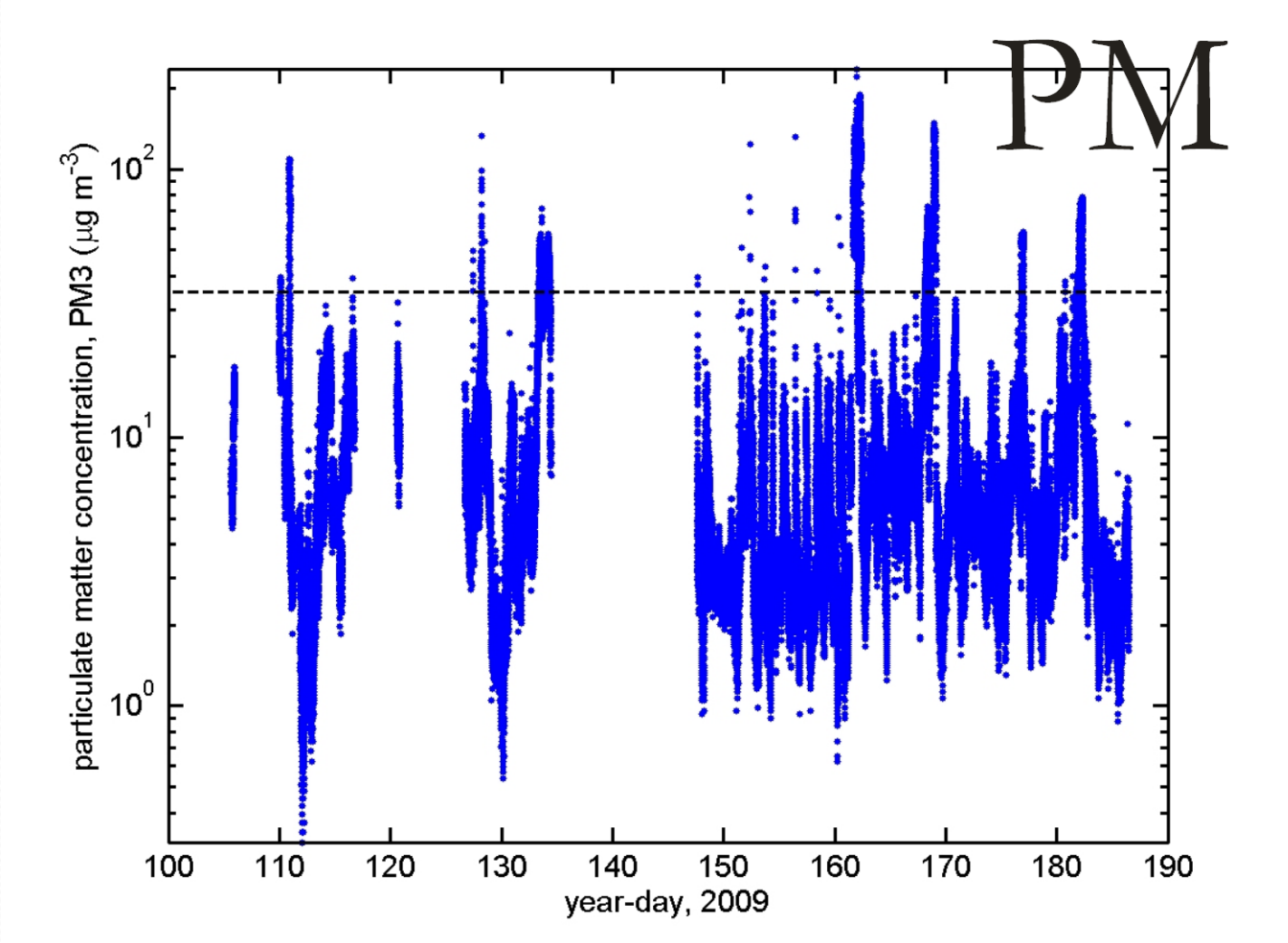




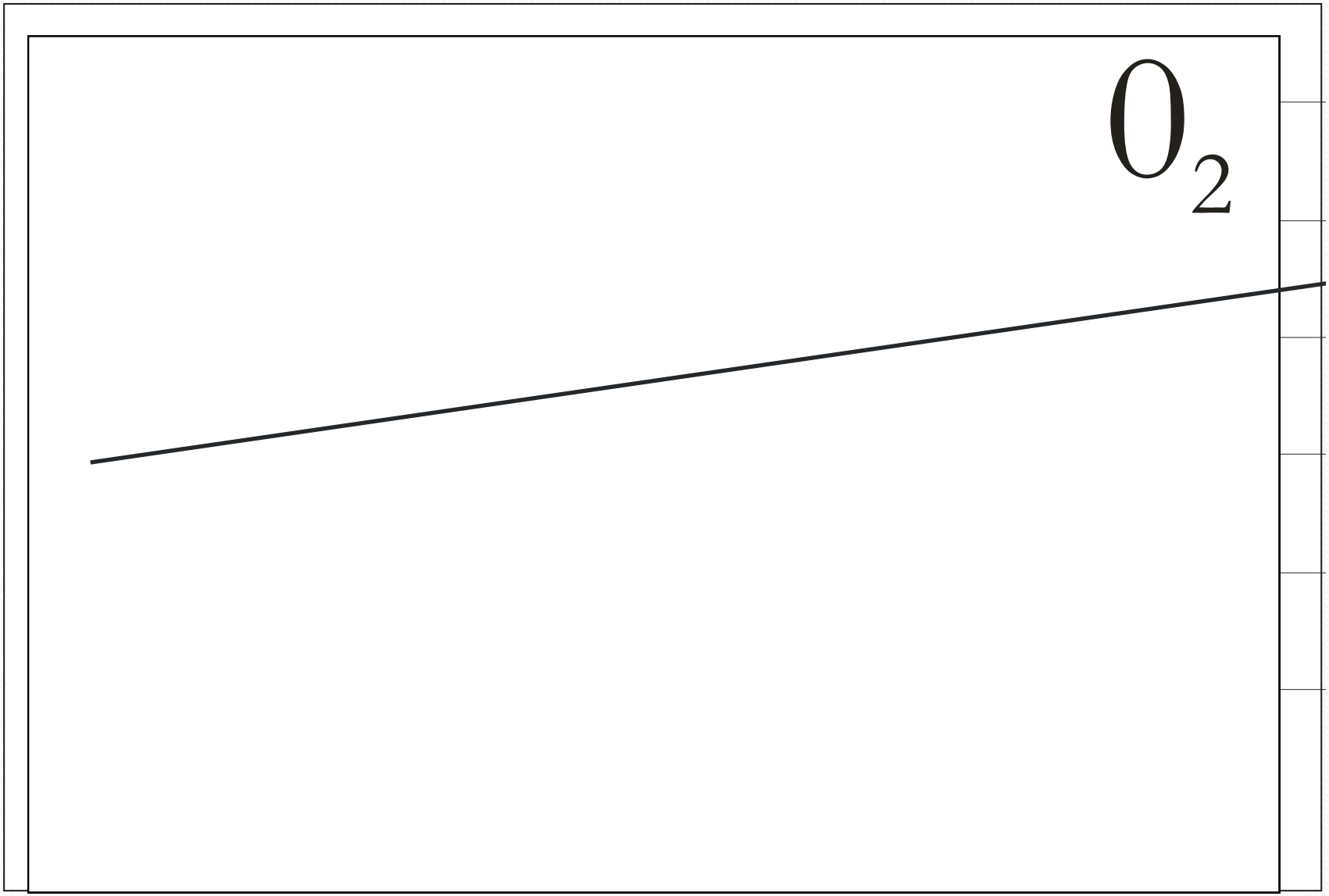
Study Area: Harlem River



Results:

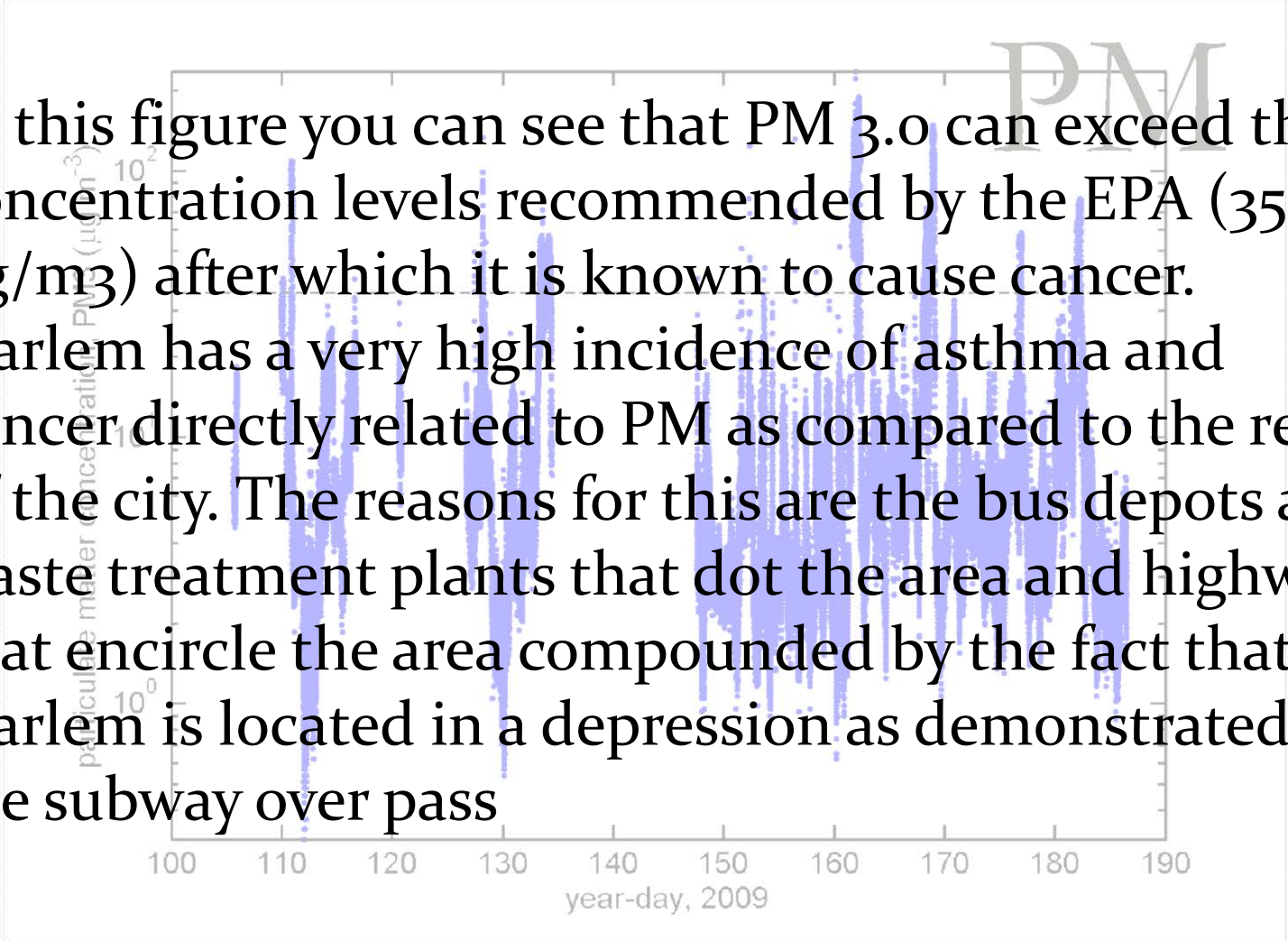

PM
particulate matter concentration, PM3 (μg m-3)
10^2
10^1
10^0
100
110
120
130
140
150
160
170
180
190
year-day, 2009

Results:



Analysis PM:

- In this figure you can see that PM 3.0 can exceed the concentration levels recommended by the EPA (35 ug/m3) after which it is known to cause cancer. Harlem has a very high incidence of asthma and cancer directly related to PM as compared to the rest of the city. The reasons for this are the bus depots and waste treatment plants that dot the area and highways that encircle the area compounded by the fact that Harlem is located in a depression as demonstrated by the subway over pass

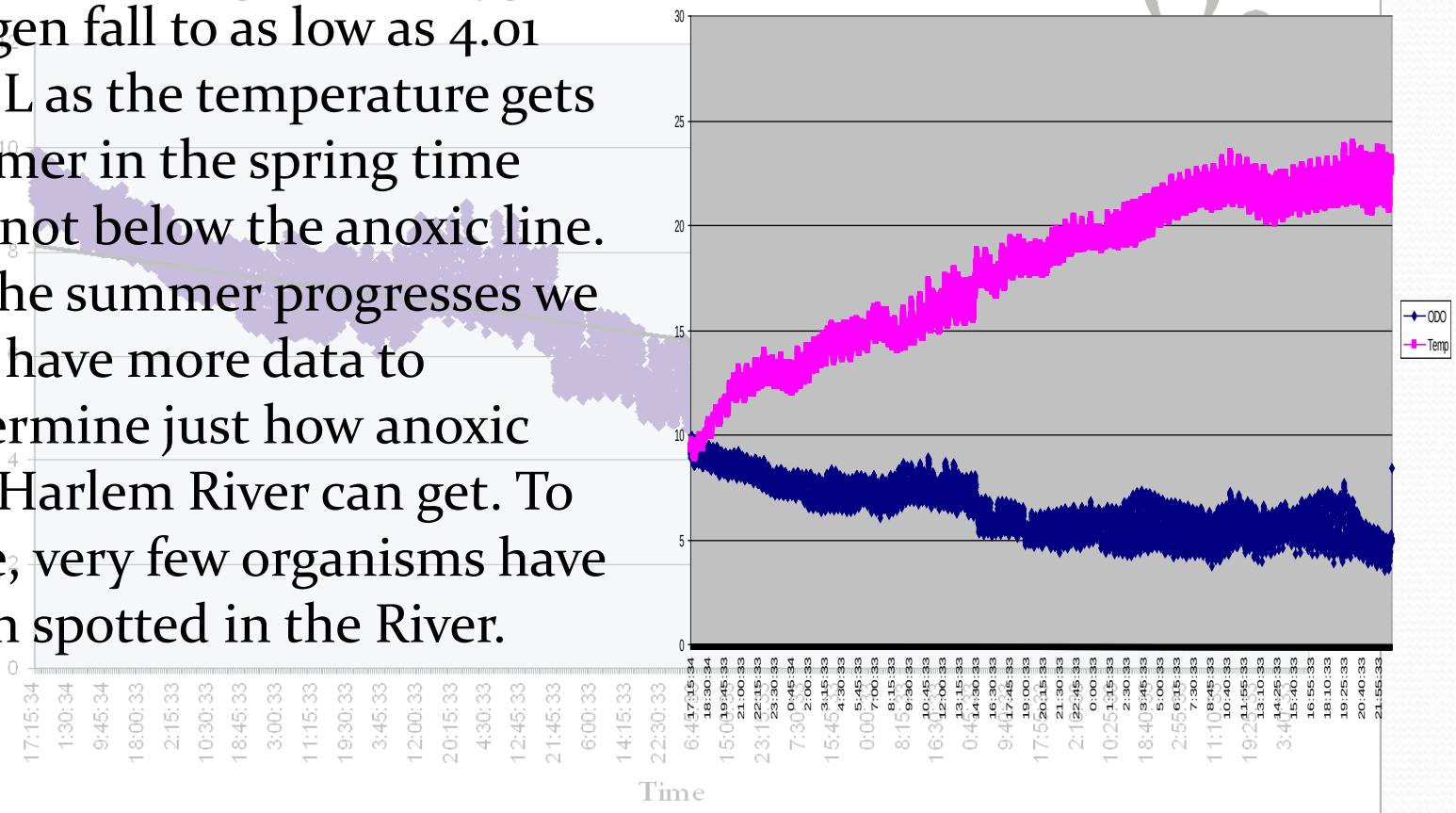


Analysis PM

- The surrounding area of our school has elevated concentrations of PM known to cause cancer.
- The risk of cancer in the surrounding area of the school within a 5 block radius in any direction is higher than one in every 10,000 people (EPA, 2009).
- If 3,000 people go through FDA every year, every 3 years 1 person will be at risk of developing cancer just from breathing the air. Most kids are at FDA for 6 years doubling their chances.

Analysis DO:

- In this figure the levels of oxygen fall to as low as 4.01 mg/L as the temperature gets warmer in the spring time but not below the anoxic line. As the summer progresses we will have more data to determine just how anoxic the Harlem River can get. To date, very few organisms have been spotted in the River.



Analysis DO:

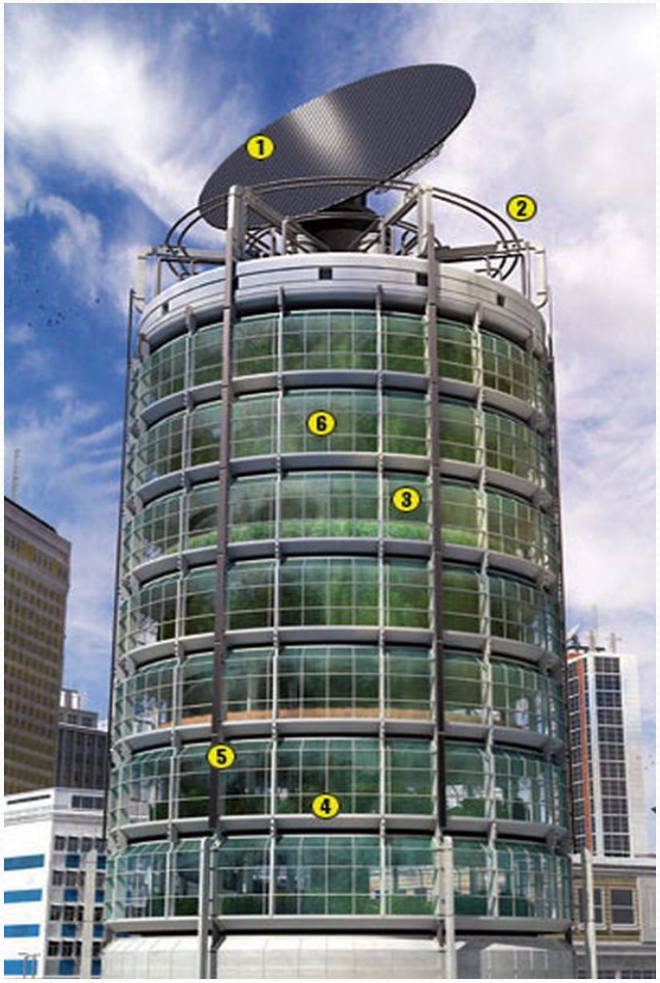
- On May 23rd we found a Toad Fish *Opsanus sp.* in our crab trap.
- We also caught small crabs *Hemigrapsus sanguineus* (exotic asian shore crab) in the trap.
- Several Sargassum fronds were seen floating by as well.
- The River may well harbor a complete ecosystem with these organisms that are known to eat various invertebrates.

Conclusions - Solutions

- One way to bring PM in the atmosphere down and improve the environment is to employ Urban Vertical Agriculture (UVA).
- UVA will grow food locally curbing the use of trucks to deliver food which in turn will reduce the amount of diesel particulates which elevate the concentration of harmful 3.0 micron PM that causes cancer.
- UVA will use alternative energy sources that will curb the burning of fossil fuels that contribute to PM and CO_2 thus making our city cleaner.
- UVA will recycle water and not use fertilizers that run off into our water ways thus reducing eutrophization.

Examples of Vertical Farms

(Despommier, 2009)



Examples of Vertical Farms

Conclusions - Solutions

- Using alternative energy such as aolic and solar power on the roofs of buildings can generate enough clean electricity to completely stop the use of burning fossil fuels for the production of electricity.
- Putting above ground enclosures over major highways with filters to clean the air produced by the trucks that use the roads that line Harlem.
- Win back the Harlem River water front all along its length and push out the bus depots to spread them out equally and increase the leisure aquatic activity of Harlem residents to improve our health.

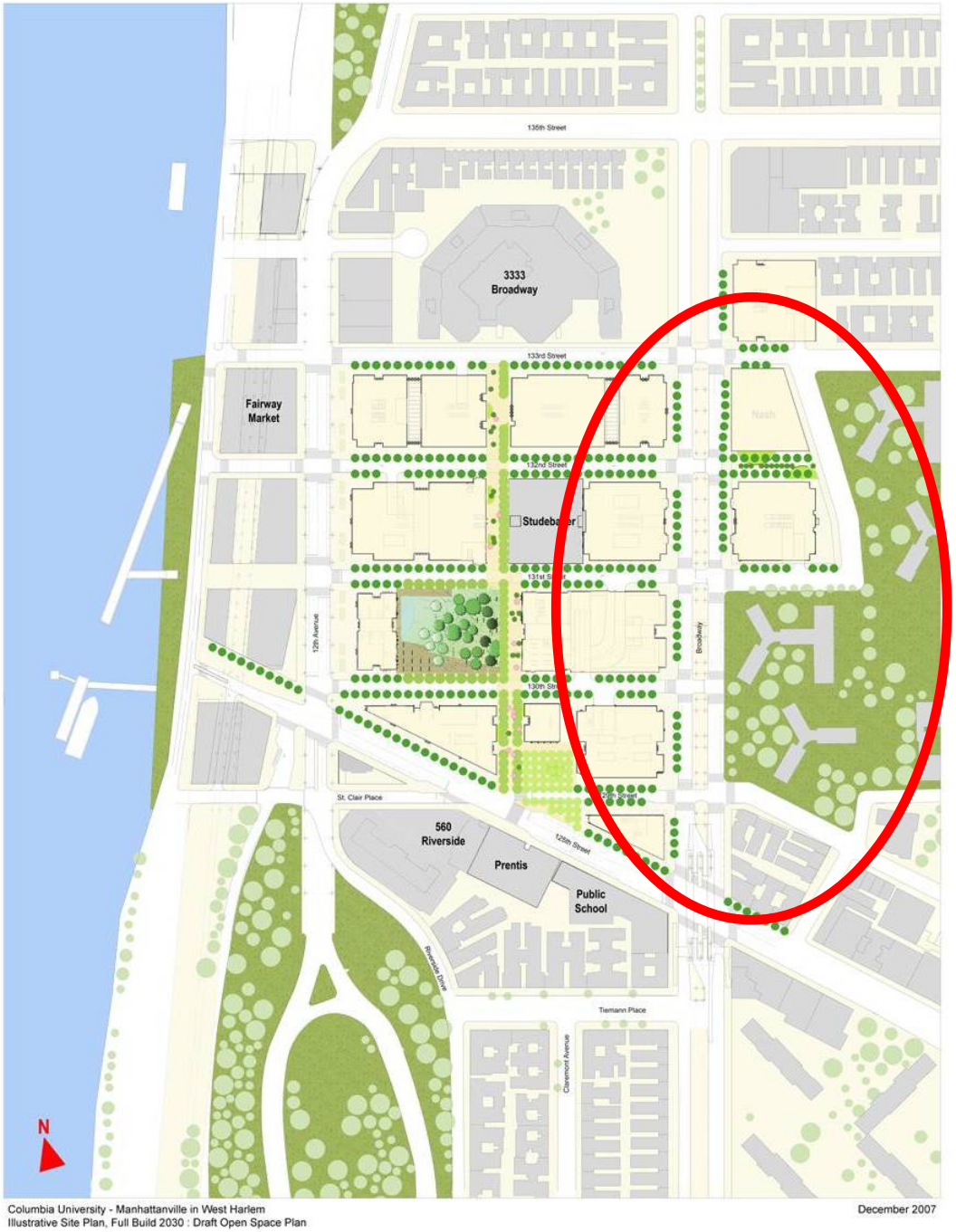
Examples of Solutions

http://cache.gizmodo.com/assets/images/4/2008/06/55/40/55406f5257e79949cf9ed97d5666140f.jpg

http://cache.boston.com/resize/bonzai-fba/Globe_Photo/2008/01/27/1201490697_8860/539w.jpg

West Harlem Piers Park

West Harlem Piers Park – turn it upside down and you get – Harlem River Piers Park…



Example – Bronx River

http://graphics8.nytimes.com/images/2008/06/12/nyregion/Pool21-533.jpg

We can start small…

Our Alternative…

http://www.treehugger.com/contamination-amazon-ecuador.jpg

Community Fair:
08/07/09 – 125th St. State Building

Suggestions for Improvement

- Take long term indoor particulate matter readings in a classroom at Frederick Douglass Academy
- Take 24hr running averages of data
- Acquire the data in a format that's easier to process with Microsoft Excel

Suggests for Future Research

- Measure carbon monoxide in a classroom at Frederick Douglass Academy
- Monitor other factors in the Harlem River such as metals and bacteria counts
- Correlate our atmospheric data with prevailing wind direction

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