COMPARISON OF PM LEVELS OF TWO PUBLIC HIGH SCHOOLS LOCATED IN DIFFERENT SOCIAL-ECONOMIC LOCATIONS

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2009-2010

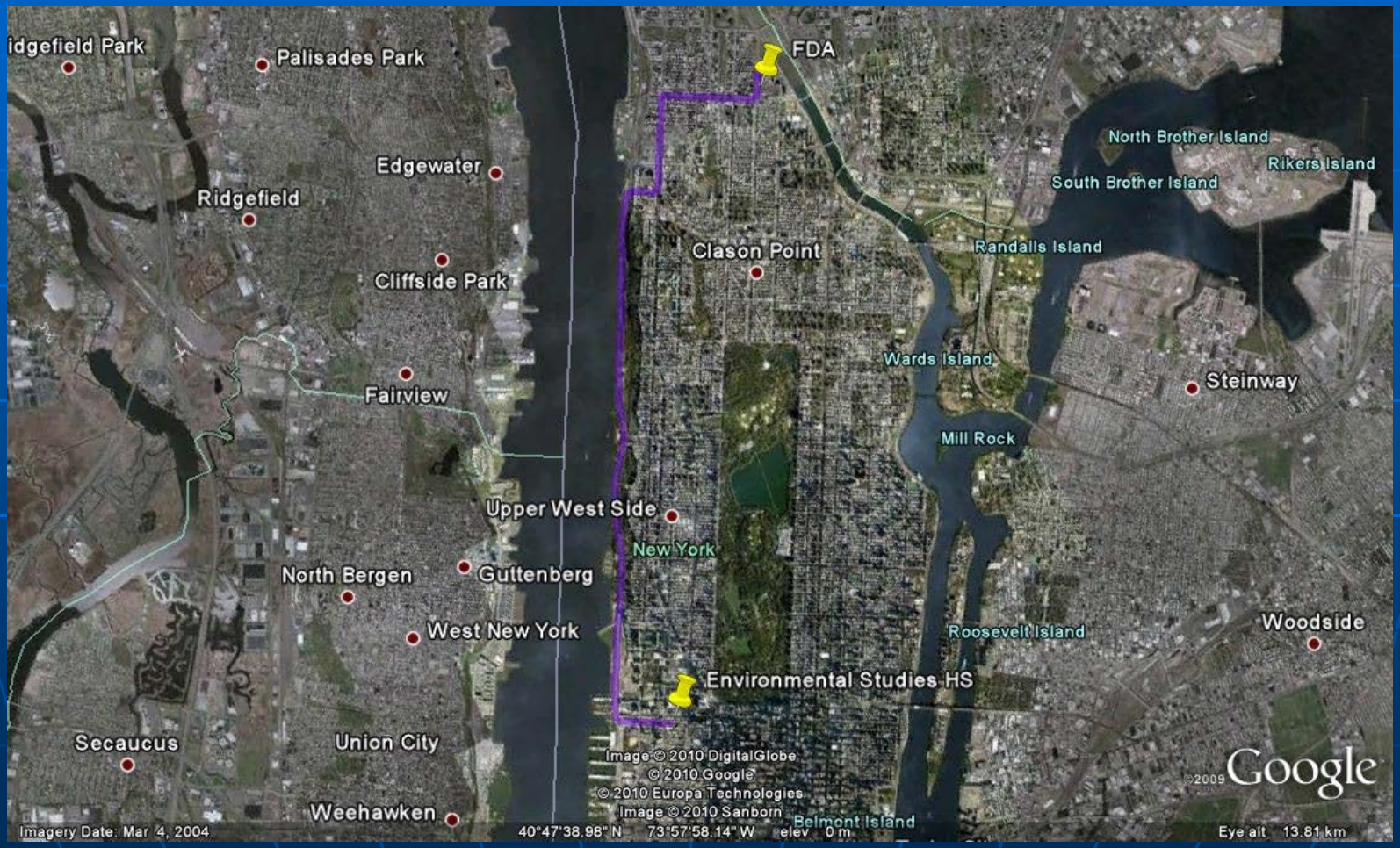
Introduction

- The PM, or Particulate Matter levels that exist in New York City surpass the Environmental Protection Agency's standards. PM is solid and liquid particles including: dust, pollen, soot, smoke, liquid droplets, and carcinogenic chemicals, that are suspended in the air (EPA, 2009). PM smaller than 3 microns cause cancer because they can penetrate the body's cells, and accumulate, disrupting the body's processes (EPA, 2009).

Introduction (II)

- Several journals have reported studies in which pollutants in the air have been linked to asthma (Perez- Pena, 2003), PM levels have been linked to lower IQ levels (Perera, 2009), and how PM levels have hindered child development (Morales et al., 2009). However, this study is unique in that the EPA's data is aging, and their methods for collection of data and equipment may have not been adequate for a study of this magnitude.

Map of the Two Localities



Project Design Chart I

Scientific Problem:	**WHAT ARE THE PM LEVELS OF TWO SCHOOLS LOCATED IN DIFFERENT SOCIAL-ECONOMIC LOCATIONS?**
Hypothesis:	The location with a lower social-economic standard will have a higher concentration of Bins 1,2, & 3 PM.
Objectives:	•Obtain data from the Aero 212 Meter simultaneously at the two localities •Determine if there are differences between localities

Project Design Chart II

Treatments:	**Localities**
Dependent Variables:	PM Levels (Bins 1, 2, & 3)
Controls:	•Time Intervals •Type of Room Being Measured •Sample time: Two Hours
Assumptions:	•Meters are Accurate •Cafeteria is the place that most students enter and thus the best place to measure

Materials List

Material	Quantity	Purpose
Aero 212 PM Meter	2	Used to obtain Bin 3 PM data
Watch/Timer	1	Used to time and date data
GPS	1	Used to find the coordinates of the PM Meter
Camera Tripod	2	Used to hold the PM Meter
Bluetooth Port	2	Used to Transfer Information from PM Meter to Computer
Signal/Power Cable	1	Used to Maintain Power Supply
Profiler Utility Software package	1	Used to syncronize computer and bluetooth
TSP Inlet head	1	Used to keep meter toghether
Standard mounting post	1	Used to hold meter in place
Inlet Heater 9431	1	Used to keep the machine at optimum temperature
Laptop	1	Used to view data
Carrying Bag	1	Used to carefully transport meter
HyperTerminal Computer Program	1	Used to open data on computer
Spip 4H Computer Program	1	Used to open data on computer

Procedures

- Have both meters calibrated by running them at the same time and finding the conversion rate that each meter needs to be multiplied by in order to get proper amount of counts per machine
- Bring one meter to the second location (Environmental Studies HS)
- Set up Aero 212 PM meter #1 in the FDA student's cafeteria by plugging the Bluetooth receiver into a laptop and power on the meter. Then run HyperTerminal to import data.
- Set up the Aero 212 PM meter #2 in the student's cafeteria at Environmental Studies High School using the same instructions
- Run the meters at the same time over a two hour period to obtain data
- Stop running both meters at the same time
- Import the data to excel in order to compare
- Compare the data from both localities to each other as well as the EPA standards
- Analyze results to find conclusions

Converting Counts To Concentrations

- To calculate the concentration from the counts, you multiply the mass of an individual particle, by the number given by the meter in counts per liter. Then the new number is multiplied by the frequency of measurements taken. Convert all units to desired units of measure (micrograms per meter cubed)

Example Using Bin 2 PM Counts

- Mass = density x volume
- Mass = $(4/3\ \Pi) \times (r^3)$
- Mass = $(2\ \text{milligrams per liter}^3) \times (4/3\Pi \times 10^{-6})$
- Mass = 8.37758041 micrograms
- Concentration = Mass x counts per liter x frequency
- Concentration = (8.37758041 micrograms) x (counts at any time) x (60/5)

Localities

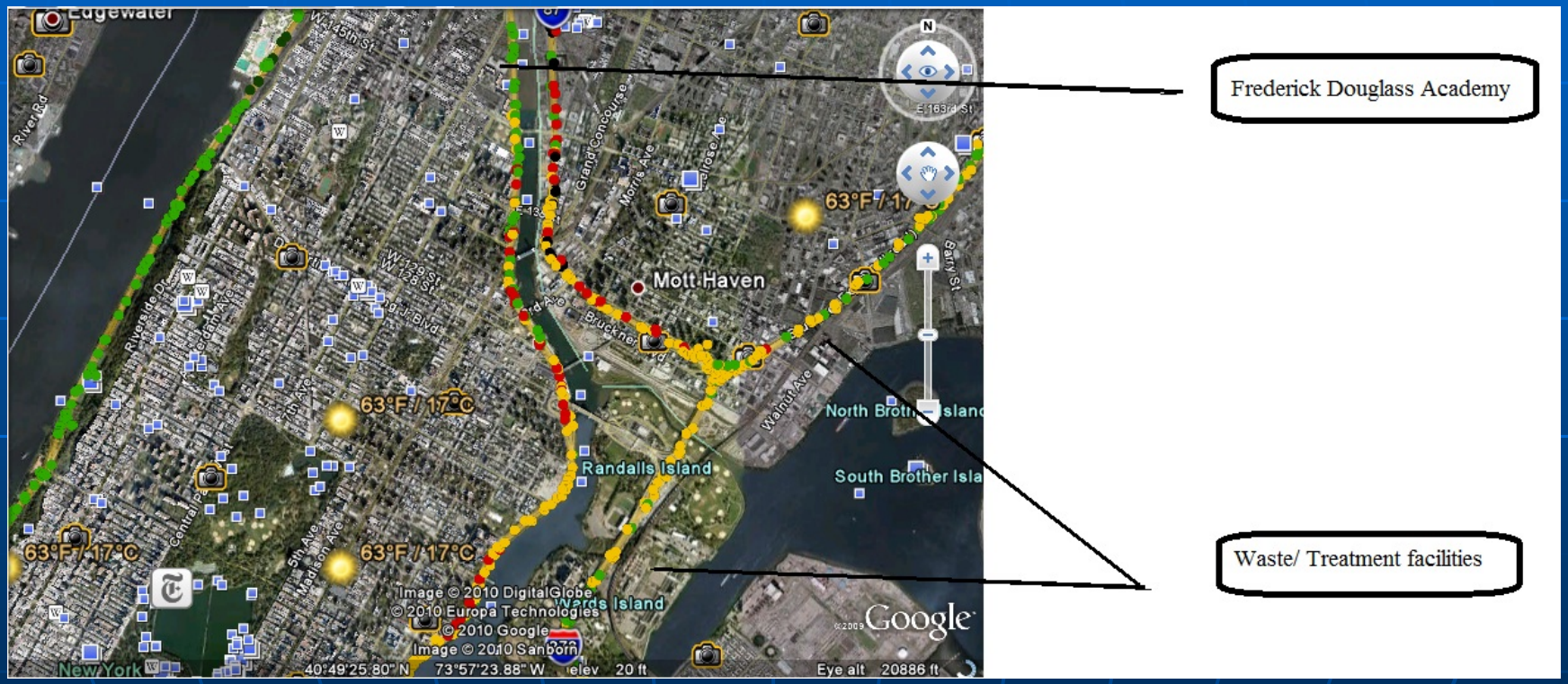
- Frederick Douglass Academy

2581 Adam Clayton Powell Jr. Blvd.
New York, NY 10039

- Environmental Studies High School

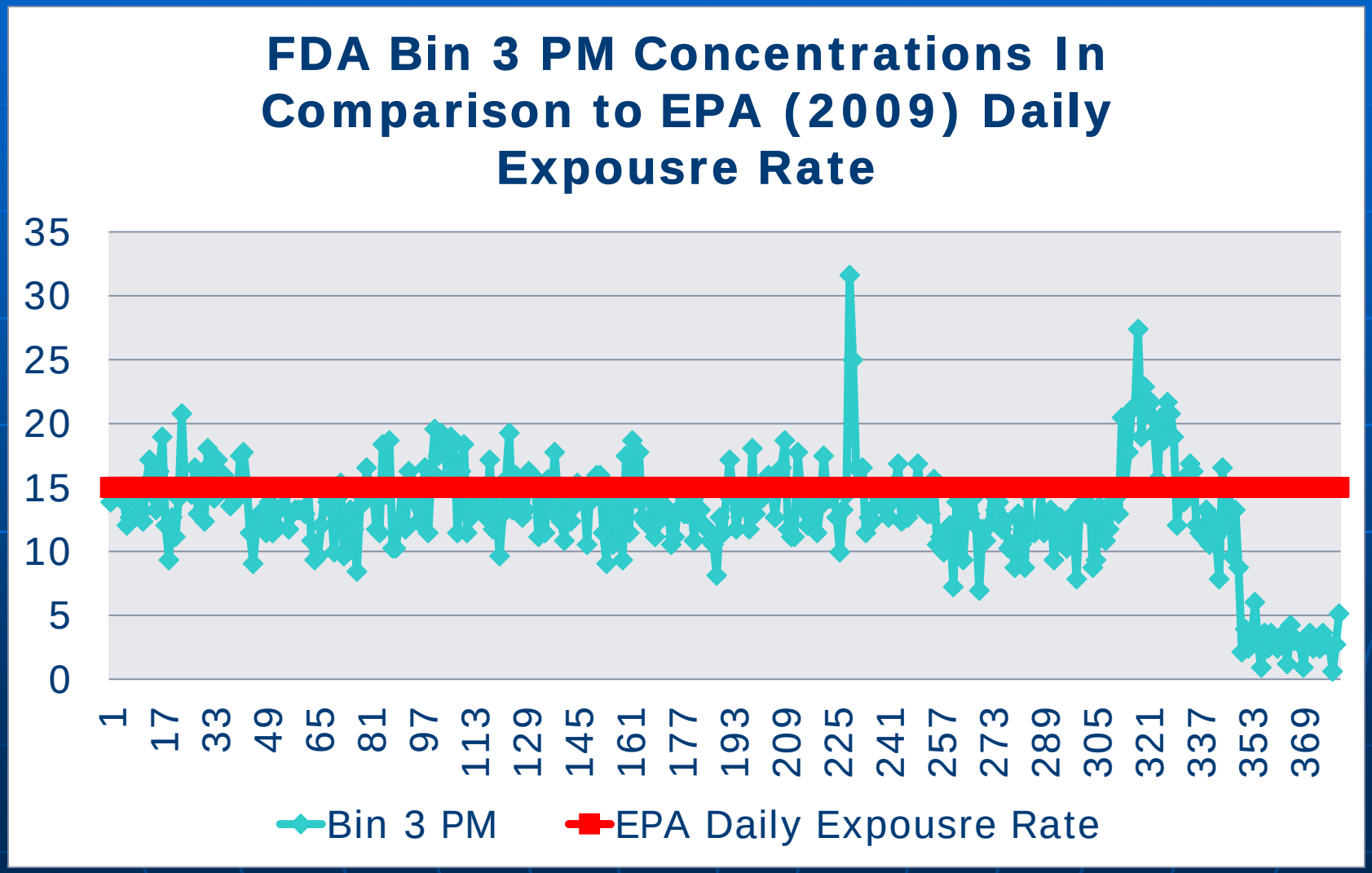
410 East 100th Street
New York, NY 10029

FDA in Relation to Waste Treatment Facilities

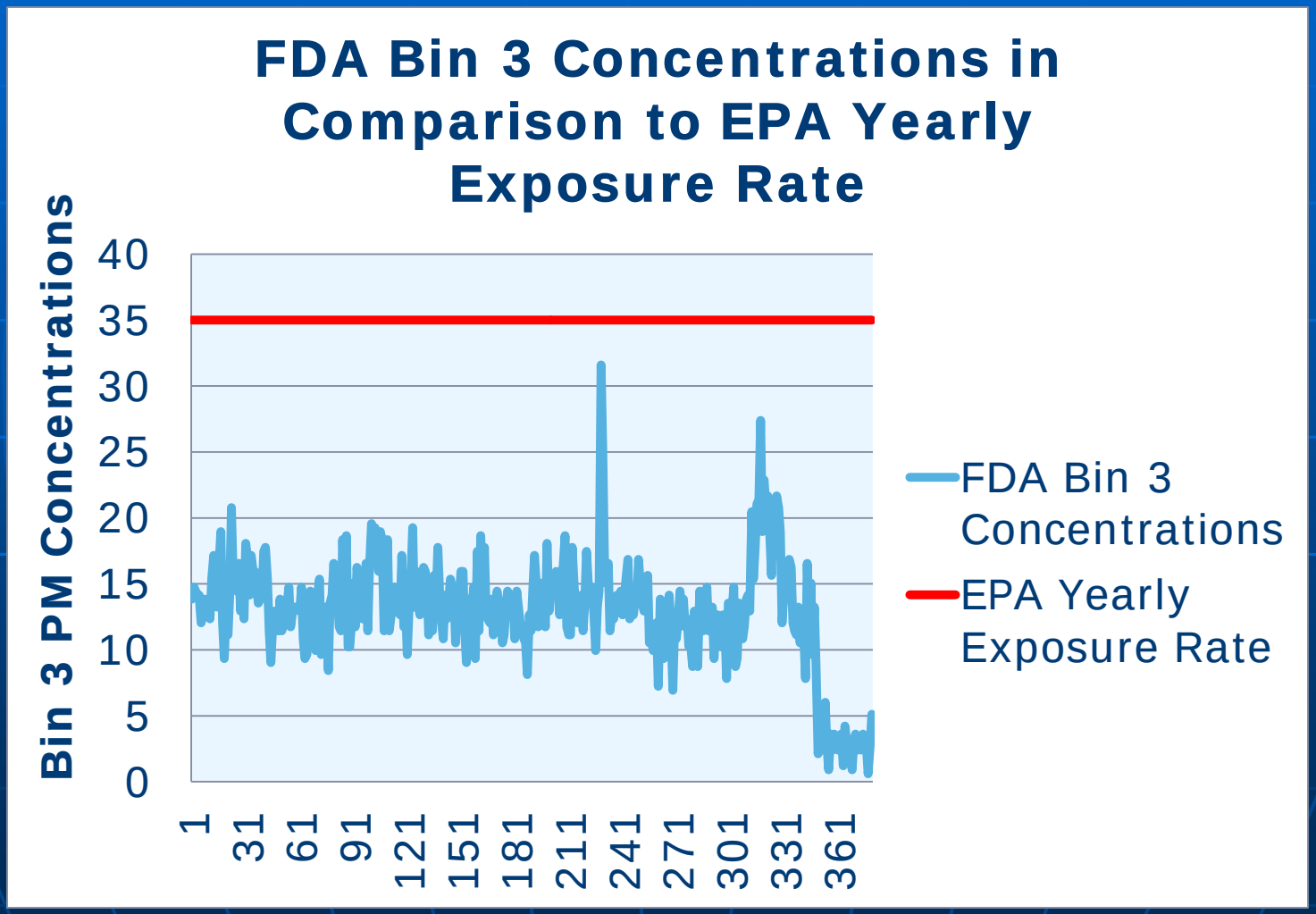


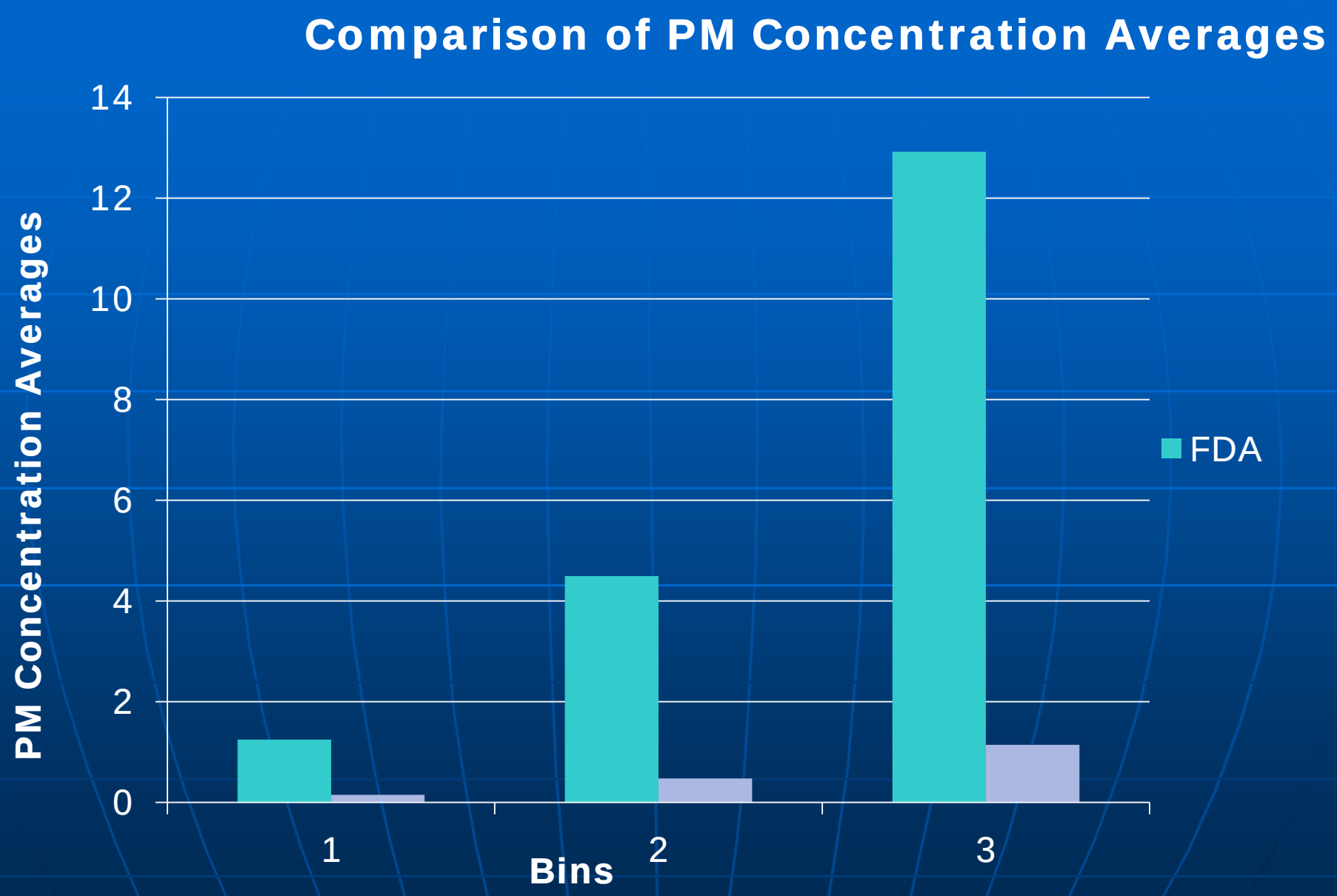
FDA in Relation to the Bus Depot (.16 Miles)

Results


FDA Bin 3 PM Concentrations In Comparison to EPA (2009) Daily Expousre Rate
35
30
25
20
15
10
5
0
1
17
33
49
65
81
97
113
129
145
161
177
193
209
225
241
257
273
289
305
321
337
353
369
Bin 3 PM
EPA Daily Expousre Rate

Results


FDA Bin 3 Concentrations in Comparison to EPA Yearly Exposure Rate
Bin 3 PM Concentrations
40
35
30
25
20
15
10
5
0
1
31
61
91
121
151
181
211
241
271
301
331
361
FDA Bin 3 Concentrations
EPA Yearly Exposure Rate


Comparison of PM Concentration Averages
PM Concentration Averages
14
12
10
8
6
4
2
0
1
2
3
Bins
FDA

Analysis of Results

- The Average Bin 1, 2, & 3 PM concentrations at Environmental Studies High School was less than those at FDA during the same time interval. Therefore, the PM levels in Harlem are higher, as suggested in a New York Times article in 2003 (Perez- Pena). These high PM concentrations can hinder child development (Morales et al., 2009). However, even with the drastic difference in concentrations, these levels exceed the EPA's daily exposure rates and are creeping up on the yearly exposure rates.

Analysis of Results (II)

- The reasons for the poor air quality are apparent. The area surrounding the school is filled with highways, rivers, a bus depot, and waste treatment facilities. Also, the school itself is often under construction; all of these factors influence the quality of air and most of these factors are controllable.

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

This Map from the EPA shows the probability of cancer in areas of Harlem. The area in which FDA is located has the highest amount of PM and thus more than 100 in a million will develop cancer from the air.

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Suggestions for Improvements

- Be more familiar with the Aero PM Sensor before going to each locality
- Have a travel plan for the getting to the second locality
- More practice setting up the meter
- Visit the second locality at least once before getting the data to become familiar
- Test run meter
- Make sure meters are calibrated
- Have a troubleshooting guide

Acknowledgements

- Mr. Maurico Gonzalez
- Dr. Gregory Hodge
- Mrs. Shirley Matthews
- Mr. Philip Orton
- Columbia University
- Jah-vin Vaughan
- Angel Batista
- Randy Garcia
- My Family