How do the Levels of Black Carbon Compare during the Day and Night on Governors Island

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Introduction

Students who attend the NY Harbor School should be more aware of what kind of air they are breathing in everyday attending to school. As you may not know, there are a few sources, such as the ventilator coming from the battery tunnel, all of the cars, emissions and construction happening around Governors island that is contributing to form Black Carbon. The data from the Black Carbon sensor outside of the schools building, specifically outside of classrooms 320's window will determine how high the levels are during the day time when students are in school, and how low the concentrations are during the night.

Background Information

Particulate matter is the term used for a mixture of solid and liquid particles emitted into the air that ranges approximately from very small to very big sizes and concentrations (MDOH, 2011). “It is small enough to be inhaled and accumulate in the respiratory system, into our lungs to blood supply, carried through our bodies” quoted by Air Quality Management Division. It has also already been proven that particulate matter penetrates into cells leading to a lot of health problems, such as cancer and asthma, and Black Carbon (BC) is a form of particulate matter (AQMD, 2001).

BC is a form of particulate matter that has recently emerged as a major contributor to global climate change; BC particles strongly absorb sunlight and give soot its black color. It is produced both naturally and by human activities as a result of the incomplete combustion of fossil fuels, bio fuels, and biomass. Primary sources include emissions from diesel engines, cook stoves, wood burning and forest fires. Soot ranks as the second-largest human contributor to climate change, according to a new analysis released Tuesday, Jan. 15, 2013, exerting twice as much of an impact as previously thought. Black carbon, or soot, contributes to warming because the fine particles absorb heat when they are in the air and when they darken snow and ice (Eilperin, 2013). BC remains in the atmosphere for only a few weeks, so cutting its emissions would immediately reduce the rate of warming and reducing exposure to BC provides public health co-benefits (C2ES, 2010).

It turns out that EPA or any other regulatory agencies don’t place such a limit on BC because it is not one chemical compound, so there is not a maximum level of how dangerous the Black Carbon can be (Ross, 2013). However since black carbon is a form of particulate matter it has been proven that they’re certain levels of pm that can be dangerous for human beings to be surrounded by to breathe in (UOC, 2008). For an example, PM10, are microscopic particles that measure less than 10 microns meaning 1,000 PM10 particles could fit side to side across one end of a standard paper clip. These particles are small enough to evade the body’s defense mechanisms and pass into the airways and the lungs, causing various health problems (ALA, 2011). According to the Unit Conversion online, 1 micron equals 1000 nanometers, which are the units used for the BC sensor’s data (UC, N/A). For the black carbon sensor we use the 880 nanometer wavelength data. The units are nanogram/meter^3 of air and the numbers will be ranging to 500, 1000, and 5000 (Ross, 2013). Thus, it would be very interesting to observe the concentrations of PM10 particles equaling to 50-1000 nanometers on a black carbon sensor after knowing the effects it plays in our daily lives.

Project Design Chart

Scientific Problem
How do the levels of BC compare during the night and day time?
Hypothesis
There are high concentrations of Black Carbon outside 320's classrooms window throughout the day time than at night because there is less human activity during the night time.
Objectives
Determine the black carbon concentration levels on Governors Island
Determine how dangerous the BC levels are to breathe in
Compare and contrast the data to other research and sources
Constants
Location of sensor and data collection time
Assumptions
Limitations
1 Black Carbon Sensor– can only set up my experiment in one box

Locality

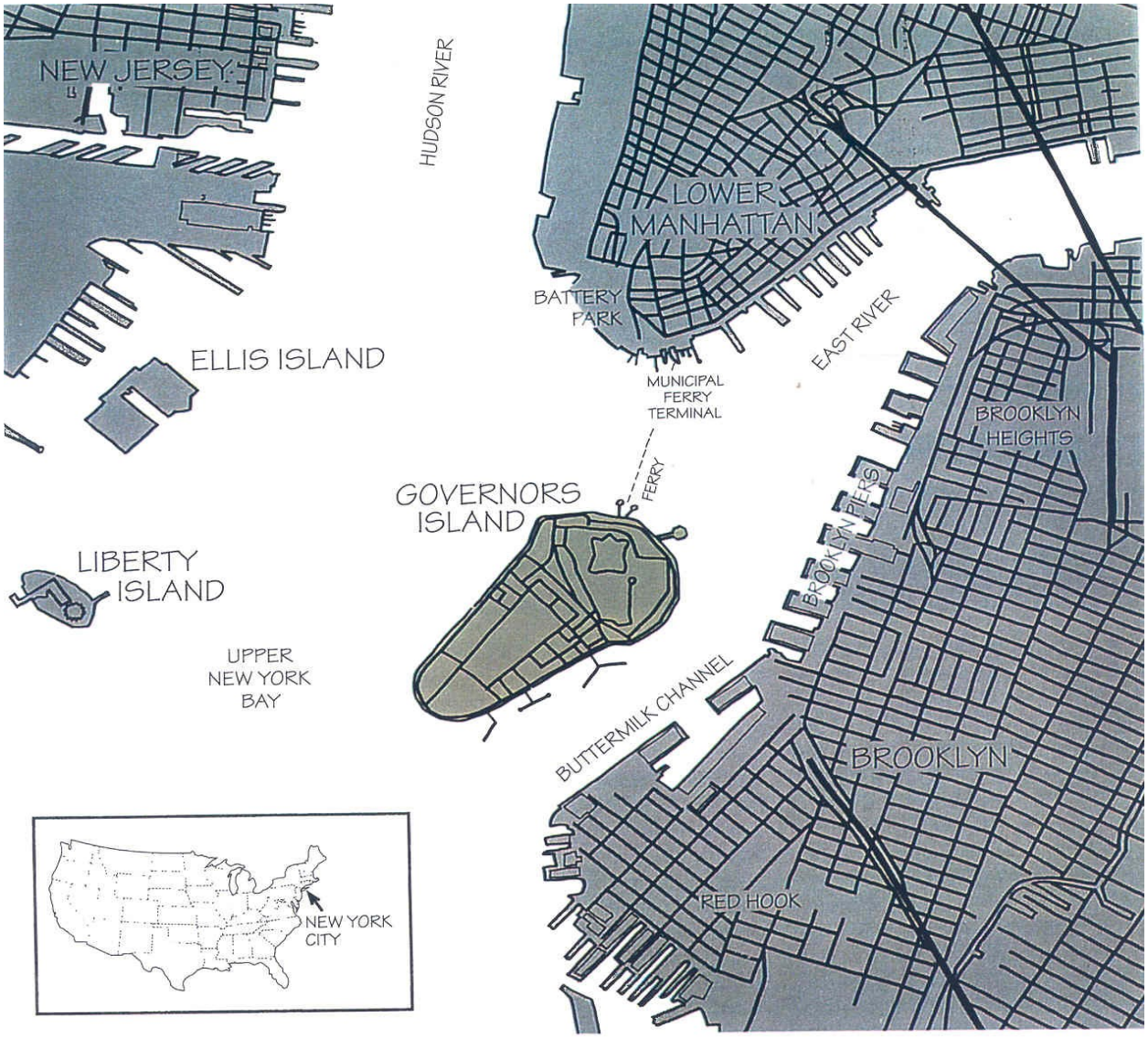

Fig 2: Determining the Black Carbon Concentrations outside a Classroom Window on Governors Island: New York Harbor School, located on Governors Island

Materials

Materials	Quality	Description
Black Carbon Sensor aetholometer	1	to determine the concentrations of BC
Classroom & window	1	to have a location to experiment from
Notebook	1	copy down any notes and important information for this project
Computers	2	to do research and organize data, presentations and drafts at home and in class

Procedures

First, set up experiment inside the classroom with the Black carbon sensor set outside the classroom's window. Then organize the collected data everyday from Dec. – Jan. of 2012 and start graphing into weeks and days using Microsoft Excel. The graph of a week will show an hour or two from the morning, afternoon, evening and night time. A data from a day will show all the concentrations of BC every 5 minutes throughout the entire day. Once graphed, start analyzing and pointing out trends and patterns between the concentrations throughout the night and day time. Furthermore, compare all the data to other data from other projects or research to have a sense of how effective the concentration of the Black Carbon is outside 320 classroom window. During this procedure, jot down notes continuously in a notebook of important information that will help gain more knowledge on the black carbon project and to help avoid forgetting valuable information.

Results

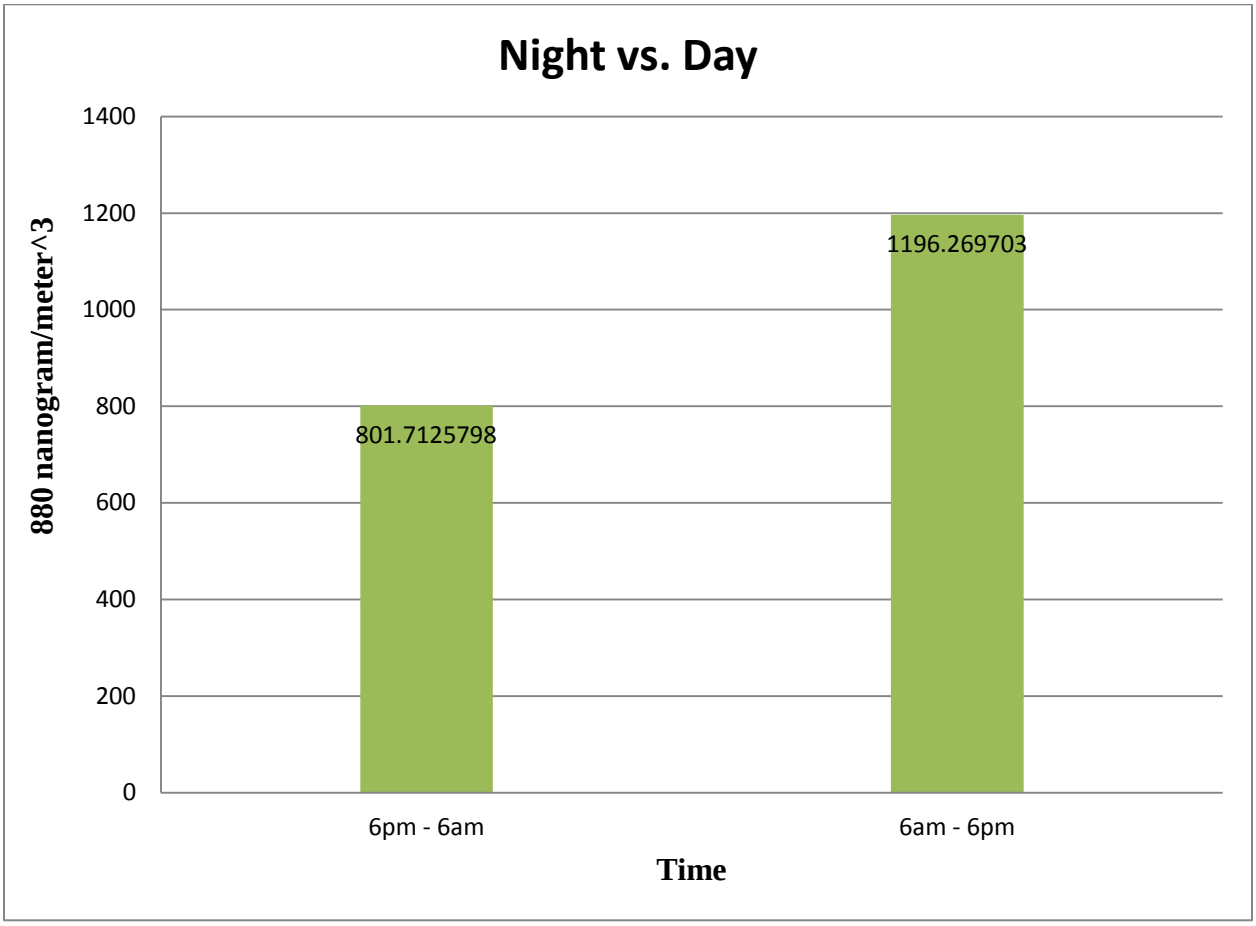

Fig 02: February 2, 2012 to February 9, 2012 (How do the levels of BC compare during the day and night time): This graph shows the average levels of Black carbon of the week of February 2nd to February 9th of 2012. The average concentration of Black Carbon during the day time of this week, starting from 6 am to 6 pm was 899 ng/meter^3. The average concentration of Black Carbon during the night time of this week, starting from 6 pm to 6 am was 758 ng/meter^3. The day average of the week was 141.5 ng/meter^3 higher than the average of the night.

Discussion

The average of the levels of BC on the days of the week shown in fig. 2 had higher averages than the night averages. The day's avg. was 1197 ng/m^3 which was 394.5 ng/m^3 higher than the avg. during the night's meaning that the night's avg. was 802 ng/m^3. "It is produced both naturally and by human activities as a result of the incomplete combustion of fossil fuels, bio fuels, and biomass. Primary sources include emissions from diesel engines, cook stoves, wood burning and forest fires" (Eilperin, 2013). In addition to this quote, BC is most likely higher during the day time because there is more human activity going on Govenors Island such as more pollution coming out of the ventilator from the Battery Tunnel from all the cars and trucks driving under it, and all the construction going on around the island throughout the day.

Conclusion

The data from the Black Carbon (BC) sensor outside of the New York Harbor School's building, specifically outside of classrooms 320's window proved how high the levels are during the day time when students are in school, and how low the concentrations are during the night time. Looking at figure 2, the observer is able to tell how much of a difference the BC levels are between the day and night. During the average day of the week shown in fig. 2, students were at school and other workers were working in other areas on Governors island who were exposed to 394.5 ng/m^3 more BC levels. This is because the average concentration of BC during the day time on the week of February 2nd to February 9th of 2012 was 1197 ng/m^3 and during the night time it was 802 ng/m^3.

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