STUDENT AIR MONITORING PROJECT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

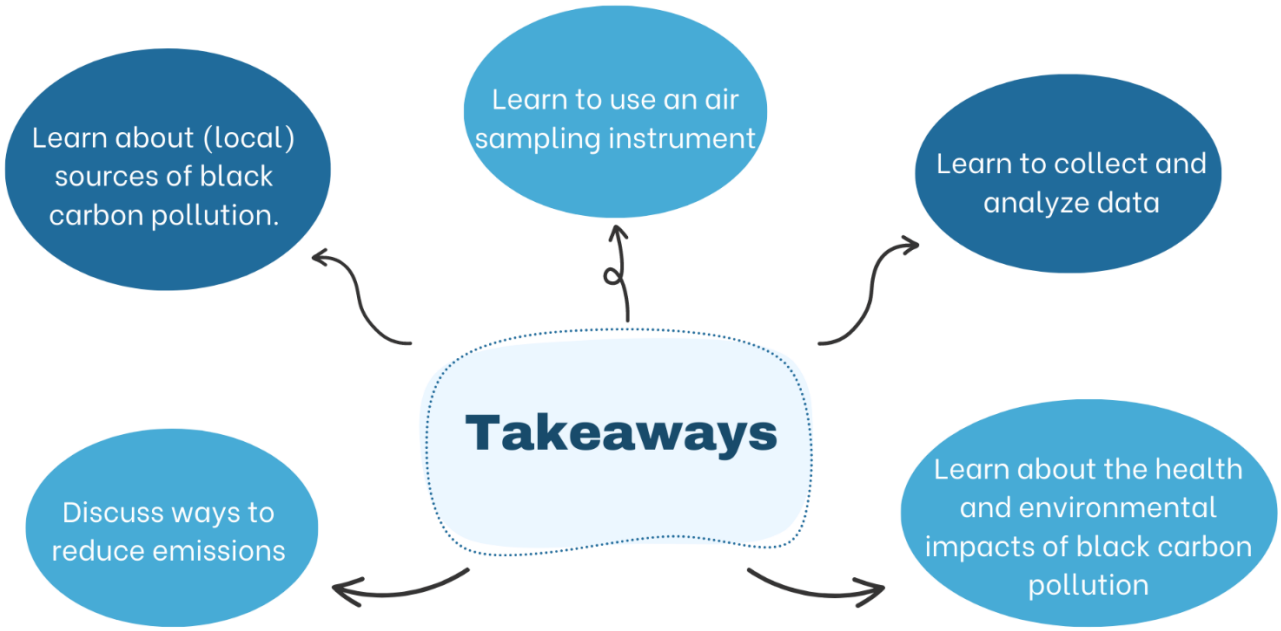
BLACK CARBON

Overview

Students can measure **black carbon air pollution**, commonly called **soot**, in their community. They will make note of the potential impact of specific types of sources and their locations. They can recommend ways to reduce emissions to help to improve human and environmental health.

- Grade level: 7-12
- Subject: Science
- Time: 3-4 class periods, including sample collection outside

Student Objectives



Materials

- microAeth® aethalometer
- Microsoft computer or laptop (software is not compatible with Apple computers)
- Clock or timer
- Clipboard to keep track of sampling locations and times
- Excel, R, or other software that can create graphs

TO BORROW AETHALOMETERS, CONTACT THE NJDEP BUREAU OF AIR MONITORING AT
BAMWEB@dep.nj.gov

Student Activity

This project was designed for use with middle and high school-age students in a school, club, or enrichment program.

The actual collection of data is done using specialized black carbon monitors called **aethalometers**. The aethalometer collects black carbon particles by streaming air through a replaceable filter strip and then uses a light-absorption technique to determine their mass concentration. When the concentration of soot is higher, more particles are captured on the filter and less light gets through.

The aethalometer used in this project is a self-contained, pocket-sized instrument with flow control, data storage and battery. Aethalometers similar to this are used by air quality monitoring programs, public health protection agencies, research laboratories and community groups.

Students should make one or two sampling trips to different locations, preferably one site with obvious pollution sources and one site without (for example a busy, truck-filled road, and then also a low-traffic park). The data will be downloaded to a computer and then analyzed. Graphs can be made to compare the results from the different locations and times.

Background Information

What is Black Carbon?

Black carbon is a primary component of particulate matter pollution, commonly called **soot**. It consists of very fine particles that form as a result of incomplete combustion of fuel, such as diesel oil, gas, wood, and coal.

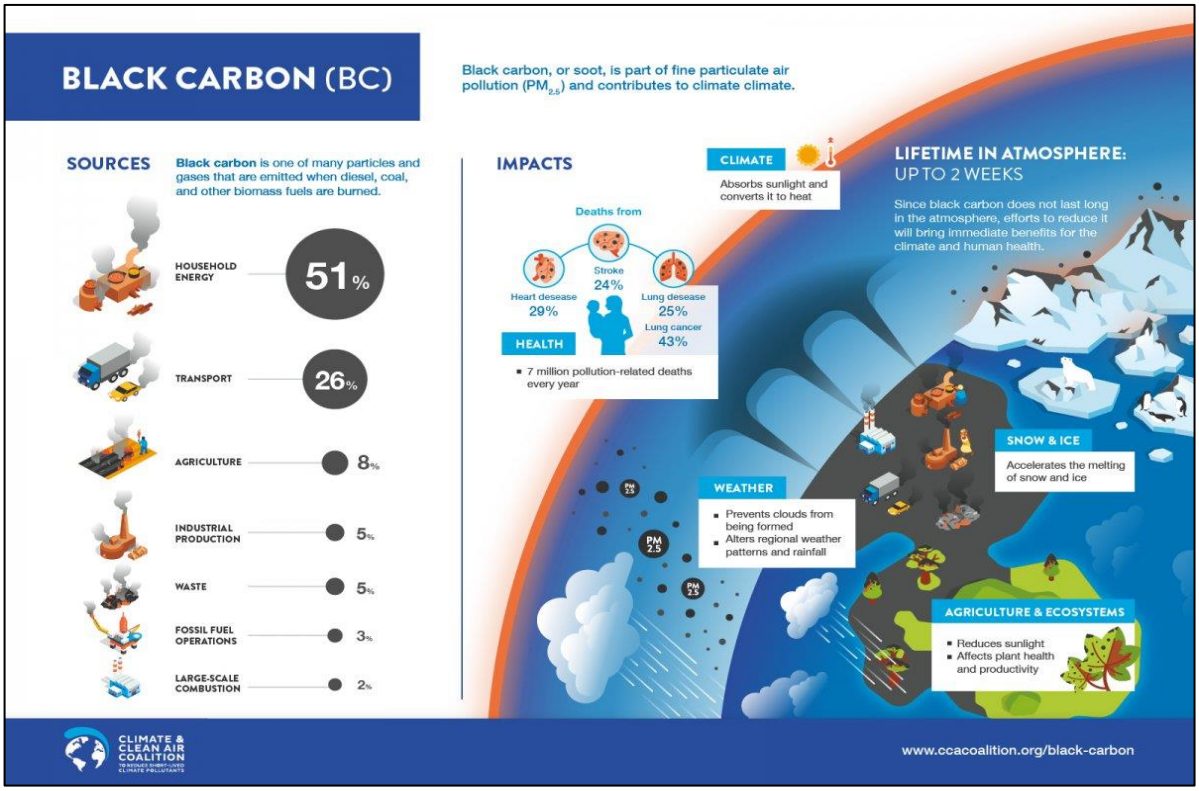
In New Jersey, black carbon pollution comes mainly from burning diesel oil in diesel engines. These are used in trucks, buses, some cars, trains, ships, construction vehicles, farm equipment, and emergency generators. Burning gas and wood are other important sources. Coal burning is a major source worldwide.

Health Effects

Particulate matter pollution is found everywhere and is known to make people sick. Very small particles can penetrate deep into the lungs. Every year in New Jersey hundreds of residents die prematurely and suffer heart and lung illnesses because of particulate pollution. Diesel exhaust can also cause cancer.

Climate Effects

Black carbon is a major contributor to climate change, second only to carbon dioxide. It heats the atmosphere by absorbing solar radiation. When deposited on snow or ice, it enhances melting.



Instructions

1. Read the aethalometer instructions and become familiar with the instrument.
2. Download the software onto a Microsoft Windows computer.
3. Test the aethalometers against each other inside.
4. Choose sampling locations and times. Aim for situations with different levels and types of potential black carbon sources. (ex: collection during car drop off/pick up)
5. Go out to sampling locations and run the aethalometers.
6. Download the data from the aethalometers using the software.
7. Create graphs to compare the different sampling locations and times.

Observations & Questions

- ***Are there different levels of black carbon in different areas?***
- ***What is a likely contributor to higher levels?***
- ***Does traffic have an impact?***
- ***Are people likely to be affected by exposure to black carbon in those areas?***

What can be done?

Emissions of black carbon can be reduced or prevented by using cleaner types of energy, electric vehicles, more efficient engines, cleaner diesel fuels, and controls that capture particulates. There are regulations in New Jersey and at the national level that help reduce emissions, but more can be done.

People can help by reducing vehicle idling, cutting back on driving, keeping engines operating properly, and reporting vehicles with visible emissions to the NJDEP (1-800-WARNDEP).

Switching to electric vehicles and solar and wind power is becoming easier as these options become more available.

New cleaner technologies will continue to be developed, but public involvement and demand are critical!

Helpful Links

NJDEP Bureau of Air Monitoring
Community Science Air Monitoring

Example Observation Sheet

Sampling Location Name	Date & Time	Description of Surrounding Activity
ex: School entrance	1/1, 8:00 AM	School buses, cars idling