

STEP THREE TEACHER GUIDE

Gathering Materials + Mastering Technology

Using experiential learning stations, your students will learn how the AirBeam measures air pollution and how the AirCasting app is used to map and graph measurements from the AirBeam.

Before students arrive, set-up one station for every 3-5 students. Each station should include at least one AirBeam, one Android or Apple smartphone or tablet (with the AirCasting app installed), and one “source” that can generate particulate matter pollution. Possible “sources” include candles, incense, pillows or stuffed animals, chalkboard erasers, matches, and spray air fresheners.

Introduce the AirBeams and smartphones/tablets to students by demonstrating how to power them on, launch the AirCasting app, and begin recording a mobile AirBeam session. These steps are detailed in the [Getting Started With AirBeam3](#) and [Mobile Monitoring with AirBeam3 videos](#). Have students review the videos from start to finish to familiarize themselves with how the AirCasting platform works.

HOW IT WORKS

Explain to students how the AirBeam detects and measures particle pollution. Key points include:

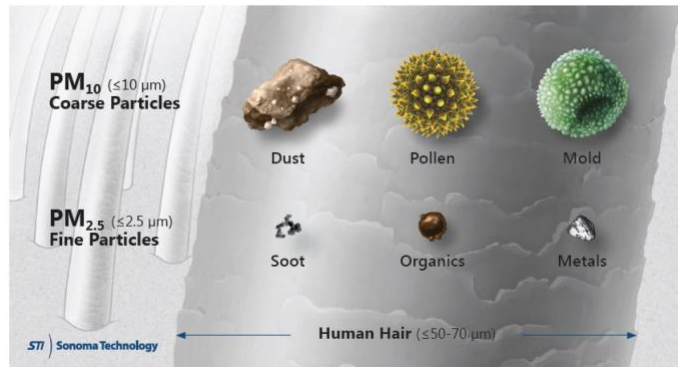


- The particulate matter sensor inside the AirBeam pulls air into its sensing chamber using a fan. Instruct students to place the AirBeam intake by their ear; they’ll be able to hear the fan quietly whirring.
- Inside the sensing chamber, light from a laser bounces or scatters off particles in the airstream. The more particles in the air and the smaller those particles are, the more the light from the laser is scattered. A detector located at the edge of the sensing chamber then measures the intensity of the scattered light and uses an algorithm to translate this into a mass based particulate matter measurement.

[FIGURE 1 on Student Worksheet]

[FIGURE 2 on Student Worksheet]

- Particulate matter is measured using mass-based units, specifically micrograms per cubic meter, which is abbreviated as $\mu\text{g}/\text{m}^3$. An AirBeam measurement of 10 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) means that if you collected and weighed all the particles in the cubic meter of air from which the AirBeam sampled, they would weigh 10 micrograms or 10 millionths of a gram. 10 millionths of a gram may not sound like much, but as shared in the Air Quality 101 Fact Sheet, there is no safe level of exposure to the smallest and most hazardous particles, like those from diesel vehicle exhaust.
- Inside the AirCasting app, you'll see three different particulate matter measurements: PM1, PM2.5, and PM10. The PM stands for particulate matter and the number represents a size cutoff. So, for instance, PM1 is a measurement of all the particles smaller than 1 micron in diameter and PM2.5 is a measurement of all the particles smaller 2.5 microns in diameter. As you remember from the Air Quality 101 Fact Sheet, smaller particles are more hazardous to human health than larger particles.
- Inside the AirCasting app, the AirBeam's PM measurements are color coded according to the health-based standards developed by the US federal government. This color coding can tell you at-a-glance how dirty or clean the air is; lower numbers and cooler colors mean the air is relatively cleaner, higher numbers and warmer colors mean the air is relatively dirtier.
- The AirBeam also measures the temperature and moisture levels inside the AirBeam enclosure. These are abbreviated as F for Fahrenheit and RH for relative humidity.



*****Now, have students take time to review the [“Getting Started With AirBeam3”](#) and [“Mobile Monitoring with AirBeam3”](#) videos before proceeding with the following experiments.****

BEST PRACTICES, ACTIVITIES, AND DISCUSSION IDEAS

To reduce the buildup of particulate matter, open classroom windows during this activity and keep them open until the PM concentrations inside the classroom match the PM concentrations measured near or just outside the classroom windows.

Once the students are at their stations, but before they've begun activating the PM sources, have them take a baseline measurement of the PM concentrations inside the classroom and near or just outside the open classroom windows and record these measurements on the Data Collection sheets. Then have students rotate among the stations and continue recording their measurements using the Data Collection sheets. At each station, have the students take turns using the AirBeam and AirCasting app.

After students have visited all the stations, have them review their data and answer the questions on their Data Collection sheets: What source emitted the most PM and why? What happened when you moved closer or farther from a source; did the concentration of PM increase or decrease and why? Are the PM measurements in the classroom higher, lower, or the same as when you started this activity; why do you think that is? After the students have had time to think through their data, have them share their answers as part of a classroom discussion.

SAFETY NOTES

- Do not spray anything directly into the AirBeams intake.
- Do not light candles incense or other flammable materials until just before you're prepared to make measurements with the AirBeam and AirCasting app.
- When you're done taking measurements, fully extinguish candles, incense, etc.