PARTICLE SOURCE SPOT TESTS ($PM_{2.5}$)

The aim of this activity is to investigate and compare common sources of fine particles and volatile organic compounds that are found in everyday environments. During this test, the goal is not to measure the pollutant levels that might be typically found in rooms. Instead, the monitor is placed a fixed distance from the sources so you can compare the peak concentrations between sources.

Safety Notice

Indoor air pollutants are associated with a range of health effects in people of all ages. Some of these effects are acute, which means they are triggered by a short-term increase in concentrations. Other effects are chronic, from exposure to slightly higher concentrations over extended time periods, perhaps years or decades. For this reason, it is important that you take steps to make sure you do not make the air quality inside worse because of these activities. To do this, you should:

1. Only pick activities or sources from the list that you would normally use in your home.
2. Pick a space where you can easily increase the ventilation rate after the activity to remove any pollutants in the air.
3. Do not decrease the ventilation below normal background levels during the activities. This means leaving windows or vents open if they are normally open, and leaving any mechanical ventilation running if it would normally be on.

You will need:

- Air quality monitor, set up and connected to device
- Ruler
- Indoor sources, choose from the list
- Pen and paper to record results
- Stopwatch (optional)

Indoor activities to test
Toasting bread
Stir frying vegetables
Frying meat (chicken, burger, bacon)
Making popcorn in the microwave
Burning candles
Burning incense
Vacuuming
Sweeping

Method:

1. Pick 3–5 possible sources from the table above.
2. Set up the air quality monitor 50 cm away from where you are going to be testing the possible sources. Follow the set-up instructions for your monitor and check that you can view the concentrations.
3. Note down the fine particle concentration at the start of your test. This is the background concentration, and for you to make a fair comparison between sources it is important the background level is the same before you test each source.
4. Use the first potential source from your list. For some sources it may be helpful to time how long it lasts or decide how long you think it should last. For example, if you are burning candles or incense, you may want to pick how long you should burn them for before starting.
5. Write down the highest particle concentration during the source activity.
6. Increase the ventilation rate until the particle concentration drops down to background levels.
7. Repeat steps 4–6 for the remaining sources.

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Results table

Background concentration: _____

Activity	Peak concentration (µg/m³)	Length of activity (seconds)

Questions to think about

1. Which source reached the highest concentration?

2. How could you present the findings?

Measuring particles

$PM_{2.5}$ is all particles with a diameter of less than 2.5 micrometres (µm), and so includes particles of a range of sizes. Some commercial monitors have been found to be more sensitive to larger particles within this range, and some didn't detect any increase in particle concentrations during events which mostly emitted particles smaller than 0.3µm across. For this reason, you might measure no increase in particle concentrations during some activities that scientists have found to emit particles.

Indoor activities to investigate were identified using the following papers:

Dacunto et al. Real-time particle monitor calibration factors and PM2.5 emission factors for multiple indoor sources. Environmental Science: Processes & Impacts. 2013; 15, 1511–1519. DOI: 10.1039/c3em00209h

Singer BC, Delp WW. Response of consumer and research grade indoor air quality monitors to residential sources of fine particles. Indoor Air. 2018;28:624– 639. DOI: 10.1111/ina.12463

Farmer, D. K. et al. Overview of HOMEChem: House Observations of Microbial and Environmental Chemistry. Environmental Science: Processes & Impacts. 2019; ISSN: 2050-7887. doi:10.1039/C9EM00228F