Forty Minute Fieldwork: Air Quality

Key topic areas	Equipment and resources required
• Sustainability • Transport • Environmental Quality • Climate Change • Health	Twelve sticky particulate capture cards* Map of the school grounds (including area immediately outside the school boundary) (* See Make your own particulate panel guide)

Context

With cases of childhood asthma continuing to rise and the introduction of ULEZs (Ultra Low Emission Zones) into many UK cities, issues around the link between vehicle-sourced air pollution and public health are frequently in the headlines. Less well understood is the highly nuanced nature of air pollution: some emissions from vehicle combustion engines are only considered environmentally toxic in high concentrations (such as carbon monoxide) while other pollutants such as particulate matter (microscopic particles of soot and metal) are considered problematic as a result of their potential lifespan in a local environment.

Aside from being potentially harmful to public health, some pollutants such as carbon dioxide and hydrocarbons contribute to climate change as they lead to an enhanced greenhouse effect in the Earth's atmosphere. Particulate matter that settles on plants' leaves can restrict photosynthesis and growth levels. Some cities such as Singapore, Los Angeles and Beijing frequently suffer from widespread smog events that can last for days.

Common emissions from a traditional vehicle combustion engine and their primary impacts	
Carbon dioxide (CO_2)	Enhanced greenhouse effect
Carbon monoxide (CO)	Poor human health
Nitrous oxides (NO_x)	Smog
Sulphur dioxide (SO_2)	Smog
Hydrocarbons	Enhanced greenhouse effect
Benzene (C_6H_6)	Poor human health
Particulates	Poor human health

Classroom set up

A useful starting point is for students to gain a wider understanding of air pollution and its impacts. Splitting a page in two, students can complete two columns - one with a numbered list of common pollutants and the other with a range of impacts felt by poor air quality. Students can then use the numbered key to match a pollutant to an impact, with the understanding that some pollutants will have many impacts and some impacts will come from more than one pollutant.

Highlighting the pollutants that come from road vehicles, teachers can ask students to consider the geographical spaces that may contain high levels of these. Teachers can then use sites such as www.londonair.org.uk to see if these ideas are correct. Looking at a map of the school site (situated in the local area) students could point out areas where they would expect particulate matter to be high (such as at a road junction where vehicles tend to idle) and expected areas of low particulate matter (along a more open stretch of road where wind currents might move more easily).

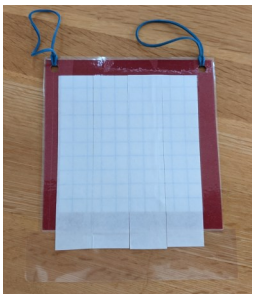
Teachers should also explain the concept of a horizontal transect along which measurements could be taken as one moves away from a particular geographical point at ground level. They should also explain a vertical transect - one which takes measurements as one moves from ground level to a higher altitude.

In the field

* Choose a time to conduct this fieldwork when the weather is forecast to be dry.

A site of suspected high particulate pollution should be identified (such as a busy road junction) and a sticky particulate capture card should be attached to a lamppost, tree or fence post as close to that spot as possible with the card sitting around 1 metre above road level. A second card should be placed in line with the first at around 2 metres above road level and if possible a third placed at 3 metres. This should be repeated at a further three sites at roughly 10 to 20 metre intervals from the first set of three cards. The cards should be left in place for 24 to 48 hours and then collected in with their location number clearly marked on them.

Students should then examine the grids on each sticky particulate capture card and count the number of squares that have visible particulate matter on them. Assuming the cards are a 10 x 10 grid, this will result in a percentage coverage score for each of the 12 locations chosen.

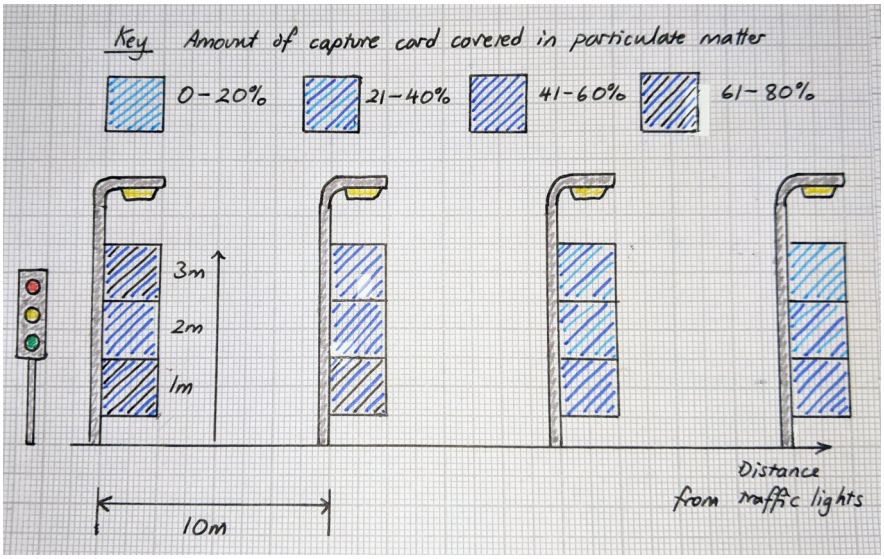


A 10 x 10 squared particulate capture card, ready to be placed outside.

Suggested data presentation

A stylised plan of the recording sites can be drawn with exaggeratedly sized blank 'cards' in place in each location. Students could then use choropleth shading to shade each 'card' on their plan according to the appropriate percentage range into which the site fell.

Alternatively, students could use the same plan of the recording site but used proportionally sized circles at each point to represent the percentage of each card that was covered in particulate matter.



Key questions for reflection and analysis

- How do particulate matter levels change as one moves away from the source site?
- Do the number and position of data recording points give a fair representation of the air quality found?
- Based on your results, would toddlers or grown ups be most affected by air pollution as they pass through this area and why?
- What environmental or social factors may have had an impact on air quality at this location?
- How might the time of day or day of the week affect air quality?
- How might the sticky capture cards be an inaccurate way of measuring air pollution?
- How could 'control' cards be used to prove the reliability of the results?
- To what extent can we be sure that the particulate matter found on the cards came from the identified source?

Taking it further

Students can examine their field site more closely and look at ways that levels of particulate matter may be reduced. They can conduct a feasibility study to see if measures such as 'no-idle' zones, tree and hedgerow planting, ULEZs or expansions of cycle networks might improve air quality without compromising other economic, social or environmental factors.