From mountain to sea

AIR QUALITY
Air Quality Teaching Toolkit

Activity Guidance

<table>
<thead>
<tr>
<th>Guidance Notes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td>Air quality levels in your area.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Workshop to look at air quality levels in different areas where you live. Discuss why levels may differ in different places and what actions you can take forward with these results. The workshop is broken down into 6 separate workshops.</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>Level 2</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Equipment required is stated below, worksheets are at the end of this document, preorder ozone badges (see pg17).</td>
</tr>
</tbody>
</table>
| **CFE Outcomes**| HEALTH AND WELLBEING: HWB 2-15a  
SCIENE: SCN 2-04b, SCN 2-12a  
SOCIAL STUDIES: SOC 2-08a, SOC 2-09a  
TECHNOLOGY: TCH 2-02b, TCH 2-06a  
LITERACY & ENGLISH: LIT 2-07a  
MATHEMATICS: MTH 2-21a |
| **Timescale**  | Estimated times given for individual tasks. |
| **Ratio**      | School ratios for outdoor activities where applicable. |
Air Quality Teaching Toolkit
Activity Guidance

Introduction
This toolkit has been developed as part of Aberdeenshire Council’s School Travel Planning initiatives with the aim to encourage sustainable, active and safe travel to school. This workshop explores the themes of air quality, what impact air pollution has and how you can improve air quality.

This toolkit is made up of the following six individual lesson plans:
1. Introducing Air Quality and Planning an Investigation
2. Investigating Air Quality
3. Analysing the Data
4. Action Planning
5. Taking Action
6. Evaluating Success

Aims
This toolkit is designed to offer fun and engaging activities to:

• Identify areas of poor air quality around your school and community;
• Promote pupil understanding of the causes and impacts of air pollution;
• Engage staff, pupils, and parents/carers in improving air quality; and
• Help identify measures that could reduce children’s exposure to air pollutants, within the school and through their travel.
### Task 1

Information on Air Quality to help aid discussion in tasks.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is air pollution?</strong></td>
<td>Air pollution occurs when gases, dust particles, fumes (or smoke) or odour are introduced into the atmosphere in a way that makes it harmful to humans, animals and plants.</td>
</tr>
</tbody>
</table>
| **Types of air pollution?**     | Things that pollute the air are called pollutants. Examples of pollutants include nitrogen oxides, carbon oxides, hydrocarbons, sulphur oxides, dust particles, and organic compounds that can evaporate and enter the atmosphere. The major air pollutants we have problems with in Scotland are:  
  - Nitrogen Dioxide (NO2)  
  - Carbon Monoxide (CO)  
  - Fine particles (PM10s and even smaller particles)  
  Ozone is a pollutant that forms in the air when some of the major pollutants above react with other chemicals in the air. |
| **What causes air pollution?**  | Air pollution can result from both human and natural actions. Natural Sources include forest fires, volcanic eruptions, wind erosion, pollen dispersal, evaporation of organic compounds, sea salt, deserts and natural radioactivity. Human activities that result in air pollution include:  
  1. **Emissions from industries and manufacturing activities.** To generate electricity, fuels such as coal, gas or oil are burned at power stations. When these fuels are burnt they release nitrogen oxides, sulphur dioxide and particulate matter as well as greenhouse gases which can cause climate change.  
  2. **Burning fossil fuels for transportation fuel.** After the industrial age, transportation has become a key part of our lives. Cars and heavy duty trucks, trains, shipping vessels and aeroplanes all burn lots of fossils fuels to work. Fumes from car exhausts contain dangerous gases such as carbon monoxide, oxides of nitrogen, hydrocarbons and particulates. On their own, they cause great harm to people who breathe them. Additionally, they react with environmental gases to create further toxic gases.  
  3. **Agriculture.** Animals like cows and sheep release a massive amount of methane through belching and breaking wind. Across the whole world, livestock is the biggest source of methane. After carbon dioxide, methane is the greenhouse gas which contributes most to climate change.  
  4. **Waste.** In the UK, methane emitted from waste disposal is the largest emitter with agriculture and livestock coming second. Methane is released into the atmosphere when the waste that we throw away decomposes. After carbon dioxide, methane is the greenhouse gas which contributes most to climate change.  
  In Scotland, nitrogen dioxide and fine particles from vehicles is a big problem in many towns and cities. |
Information on Air Quality to help aid discussion in tasks.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
</table>
| **What are the effects of air pollution?** | 1. **Health impacts.** Air pollution at very high levels can have negative health impacts. It is estimated that you breathe 20,000 litres of air each day, meaning the more polluted the air is, the more dangerous chemicals we breathe into our lungs. Depending on the level of exposure and the type of pollutant inhaled, health effects can vary, ranging from simple symptoms like coughing and the irritation of the respiratory tract to acute conditions like asthma and chronic lung diseases.  
2. **Acid rain.** Sometimes when an air pollutant, such as sulphuric acid combines with the water droplets that make up clouds, the water droplets become acidic, forming acid rain. When acid rain falls over an area, it can kill trees and harm animals, fish, and other wildlife.  
3. **Eutrophication.** Rain can carry and deposit the nitrogen in some pollutants on rivers and soils. This will negatively affect the nutrients in the soil and water bodies. This can result in algae growth in lakes and water bodies, and make conditions for other living organisms harmful. |
| **How can we make our air cleaner?** | 1. **Travel to School**  
Walk, cycle or scooter to school – it is good exercise and can reduce air pollution  
Use public transport – take the bus or train instead of the car if you can  
If you have to travel to school by car, try car-sharing with other friends  
2. **No idling**  
If you have to be picked up by car, tell your parents not to leave the engine on while they wait for you. This is called 'idling' and it is a big cause of air pollution around schools. It is also illegal in Scotland. Turning off the engine could reduce air pollution and also save your parents money.  
3. **Spread the Word**  
Discuss air quality issues with your teachers, friends, and family  
Make sure everyone you know is aware of the dangers of air pollution  
4. **Simple actions at home**  
Energy saving actions such as: switch on equipment only when needed, set the thermostat at the lowest comfortable temperature, turn off the lights in rooms you are not using. |


Other useful resources:
- Further reading: Introduction to air pollution: [http://eschooltoday.com/pollution/air-pollution/what-is-air-pollution.html](http://eschooltoday.com/pollution/air-pollution/what-is-air-pollution.html)
- DEFRA UK-AIR – air quality forecasts, current pollution levels and related news and information: [https://uk-air.defra.gov.uk/](https://uk-air.defra.gov.uk/)
- The Open Air Laboratories (OPAL) Network – Kids Zone with quizzes, activity sheets and games: [https://www.opalexplorenature.org/kidszone](https://www.opalexplorenature.org/kidszone)
Task 1

Introducing Air Quality and planning an investigation

Take a small group out on to a safe area outside of the school (pavement if necessary). It is most useful for pupils to experience real life situations by taking them on to pavements alongside roads around the school, but it may not always be possible to do this due to road conditions or pupil ratios. Creating pavements and roads with cones of chalk within the playground is an alternative.

Guidance Notes

<table>
<thead>
<tr>
<th>Activity</th>
<th>In Class introduction and discussion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Pupils will learn what air pollution is, what causes it, how it affects us and what we can do to make our air cleaner. Pupils will also learn how to make predictions, ask scientific questions, plan how to answer their questions, use large-scale maps and research and discuss topical issues.</td>
</tr>
<tr>
<td>Age</td>
<td>Level 2</td>
</tr>
<tr>
<td>Equipment</td>
<td>Air pollution lesson sheet; a big large-scale map of the school and surrounding area; A4 copies of maps showing the same area; red and green sticky dots; pens and paper.</td>
</tr>
</tbody>
</table>
| CFE Outcomes | HEALTH & WELLBEING: HWB 2-15a
LITERACY & ENGLISH: LIT 2-07a
SCIENCE: SCN 2-04b, SCN 2-12a
TECHNOLOGY: TCH 2-02b, TCH 2-06a
SOCIAL STUDIES: SOC 2-08a, SOC 2-09a |
| Timescale | 30-35 minutes |
Introducing Air Quality and planning an investigation

Take a small group out on to a safe area outside of the school (pavement if necessary). It is most useful for pupils to experience real life situations by taking them on to pavements alongside roads around the school, but it may not always be possible to do this due to road conditions or pupil ratios. Creating pavements and roads with cones of chalk within the playground is an alternative.

### Instructions

**a)** Introduce the topic of air pollution (using the air pollution lesson sheet and the introduction to air pollution section) - as a class, explore what air pollution is, types of pollution, what causes pollution and what are the effects.

Ask pupils:
- How they think air quality might be different on a busy road and in a quiet area away from traffic;
- To turn their predictions into a scientific question that can be investigated; and
- How they think they could find an answer to their question.

Types of pollution online activity: [http://www.learnaboutair.com/primary/pollutants.html](http://www.learnaboutair.com/primary/pollutants.html)


**b)** Tell pupils some of the ways air quality can be measured - see Citizen Science Activities for examples:

- Lichen Bio-Indicator Study – identification of different types of lichen on trees and other surfaces;
- Diffusion Tube Samples – diffusion tubes used to measure the level of harmful nitrogen dioxide in the air;
- Ghost Wipes – measure the amount of heavy metals in air-borne particulate pollutants that collect on surfaces;
- Surface Wipe Analysis – sticky tape or cotton wool is used to sample the particulate matter that is deposited on surface.

**c)** Tell pupils that they will be using Ozone Badges in the next lesson (Task 2) to measure air quality. These are used to easily identify harmful Ozone in the air, and provide a near immediate result displayed through a colour change in the badge. Check understanding of Ozone with the class – ozone forms as a result of the reaction of sunlight with vehicle emissions (nitrogen dioxide and volatile organic compounds in particular). You can sometimes see it as smog, and it can spread to rural areas from towns and linger for a long time. It can cause eye and nose irritation as well as harming your lungs, and plants. [https://uk-air.defra.gov.uk/assets/documents/What_are_the_causes_of_Air_Pollution.pdf](https://uk-air.defra.gov.uk/assets/documents/What_are_the_causes_of_Air_Pollution.pdf)

**d)** Group Activity: Organise pupils into groups of 4 or 5 and provide each group with an A4 map of the area and some red and green sticky dots. Pupils should discuss in their groups where they think the air will be most polluted and why, and they should mark these locations on the map with the red dots. They should then discuss where they think the air will be cleanest and mark these on the map with the green dots.

**e)** Ask one group to tell the class one of the places where they thought the air would be most polluted and why. Do the other groups agree? Mark this place with a red dot on the large map displayed at the front of the class. Then ask the next group to say a different place and repeat the process until all the most polluted places have been marked. Now do the same with the least polluted places. Mark these with green dots. As a class, select 3 locations that pupils can visit during the investigation. Ensure that these locations are varied e.g. school, road or busy main street and a park or green area. Give each site a name and number so that data can easily be referenced back to the map. If it’s not possible to leave the school, try to pick areas with some variety within the school grounds.
# Task 2
Investigation into Air Quality

<table>
<thead>
<tr>
<th>Guidance Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td><strong>CFE Outcomes</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Timescale</strong></td>
</tr>
<tr>
<td><strong>Ratio</strong></td>
</tr>
</tbody>
</table>
## Task 2
Investigation into Air Quality

### Instructions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **a)** | • Depending on staff resources will depend on how schools wish to organise this section. Either:
|   | • As a class attend each of the 3 selected sites to conduct your air quality assessments. Give groups of 3, 3 Ozone badges each to measure the concentrations of harmful Ozone in the air at each of the three sites.
|   | • Or divide the class into 3 with each group only visiting one site each. |
| **b)** | With each Ozone badge, pupils should remove their seal and leave them for 10 minutes. After this time, pupils should compare the colour change to the control sheet to measure the amount of Ozone and record the results on the Ozone Badge Record Form. |
| **c)** | If there is sufficient time to do so, pupils could complete a labelled sketch of the place or places where they carry out their data gathering. |
Task 3

Analysing the Data

Guidance Notes

<table>
<thead>
<tr>
<th>Activity</th>
<th>On street activity gathering data on air quality levels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Pupils will learn to collect scientific evidence that will be used to identify concentrations of harmful Ozone in the air. Pupils will learn to use scientific equipment, carry out fieldwork investigations and make a labelled field sketch.</td>
</tr>
<tr>
<td>Age</td>
<td>Ozone Badge Record Forms (from previous session); equipment for chosen method of presenting data (e.g. graph paper); coloured pencils; scrap paper; large sheet of paper.</td>
</tr>
<tr>
<td>Equipment</td>
<td>HEALTH &amp; WELLBEING: HWB 2-14a</td>
</tr>
<tr>
<td></td>
<td>MATHEMATICS: MTH 2-21a</td>
</tr>
<tr>
<td></td>
<td>SCIENCE: SCN 2-04b, SCN 2-12a</td>
</tr>
<tr>
<td></td>
<td>TECHNOLOGY: TCH 2-02b, TCH 2-06a</td>
</tr>
<tr>
<td>Timescale</td>
<td>1 hour</td>
</tr>
<tr>
<td>CFE Outcomes</td>
<td>SOCIAL STUDIES: SOC 2-08a, SOC 2-09a</td>
</tr>
</tbody>
</table>
### Task 3
Analysing the Data

**Instructions**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a)</strong></td>
<td>Discuss results as a class. What are they?</td>
</tr>
<tr>
<td><strong>b)</strong></td>
<td>Discuss the impact of these results. In what kinds of places is the air most polluted? Did the evidence confirm or contradict their predictions? Did anything surprise them? What do they think happens when people breathe in air in the most polluted places? What could be done to reduce the amount of pollution in the air? What could they do to limit their exposure to air pollution?</td>
</tr>
<tr>
<td><strong>c)</strong></td>
<td>As a class, decide on the best way to present the data (e.g. bar graph, line graph etc.). This could then be done as a class, group or individual activity.</td>
</tr>
<tr>
<td><strong>d)</strong></td>
<td>In groups of 4 or 5, ask pupils to make a list of recommendations based on their findings. These could be long term (e.g. reduce traffic, promote electric cars, redesign engines to use less petrol), medium term (e.g. campaign to reduce idling outside school gates, develop a school travel plan), or short term (e.g. take a different route to school).</td>
</tr>
<tr>
<td><strong>e)</strong></td>
<td>Take feedback from the group and write up a class list of recommendations on a large sheet of paper. Keep the paper for the next session.</td>
</tr>
</tbody>
</table>
## Task 4

### Action Planning

<table>
<thead>
<tr>
<th>Guidance Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
</tr>
</tbody>
</table>
| **CFE Outcomes** | HEALTH & WELLBEING: HWB 2-15a  
SCIENCE SCN 2-04b, SCN 2-12a  
TECHNOLOGY: TCH 2-02b, TCH 2-06a  
SOCIAL STUDIES: SOC 2-08a, SOC 2-09a  
LITERACY: LIT 2-29a |
| **Timescale** | 1 hour |
Task 4
Action Planning

Instructions

a) As a class, read through the list of recommendations from the last session.

b) In groups of 4 or 5, pupils should discuss the 4 points below and one person in each group should note down the group decisions:
   1. Decide on one recommendation that they would like to take action on.
   2. Discuss what would be the best way to take action – for example:
      - Influence someone in a position of power (e.g. an MSP or Local Councillor or Council Officer) by writing a letter or inviting them into school to respond to questions
      - Influence their parents or local people by designing a leaflet, putting on a play, or sharing their site visit findings in the school newsletter
      - Take action as a school by developing a school travel plan, running a campaign to encourage more walking/ cycling
      - Inform other pupils through an assembly presentation, designing posters, or by promoting quieter walking and cycling routes
   3. Think about the most effective way to influence others by:
      - Deciding on the message they want to get across
      - Deciding who they want to share their message with
      - Thinking about what will appeal to this group of people – would the audience respond best to facts, stories, pictures etc.?
   4. Decide how they would know whether their action had been successful.

c) Class Discussion: Ask each group to present their ideas. Collect in the notes made by each group as they will be needed for the following lessons.

d) Either vote on which action the class would like to carry forward together or each group could develop its own plan.
## Task 5

### Taking Action

<table>
<thead>
<tr>
<th>Guidance Notes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Notes from Lesson 4; other resources will depend on the actions/methods chosen during Lesson</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>Notes from Lesson 4; other resources will depend on the actions/methods chosen during Lesson.</td>
</tr>
<tr>
<td><strong>CFE Outcomes</strong></td>
<td>Expressive Arts: EXA 2-01a, EXA 2-05a</td>
</tr>
<tr>
<td><strong>Timescale</strong></td>
<td>Flexible – Approximately 1.5 hours</td>
</tr>
</tbody>
</table>
Task 5

Taking Action

Instructions

a) As individuals or in groups, proceed with the chosen method of ‘taking action’. Ideas include:

**Letter Writing:** Pupils could write a letter to influence someone in a position of power or to invite them into school to respond to questions.

**Leaflet Design:** Pupils could design a leaflet to inform parents and local people about air quality issues.

**School gate banner design:** Pupils could design a schoolgate banner to display messages around vehicle idling to parents and carers. Use a local print shop to get it printed in hardwearing material.

**Putting on a Play:** Pupils could make up a play to inform fellow pupils, parents and members of the community about air quality issues.

**Poster Design:** Pupils could design posters that can be displayed throughout the school to inform other pupils and parents about air quality issues.

**School Newsletter:** Pupils could share the findings of their air quality investigation in the school newsletter.

**Assembly:** Pupils could write and deliver a presentation for assembly.

**Moth Competition:** Pupils could draw and cut out a big black moth. Each member of the class can make an air quality pledge (e.g. to walk or cycle to school). Each morning the class can put a white dot on the black moth if they have done their pledge until the black moth is covered in white dots, symbolising less pollution (N.B. there is an accompanying story and activity sheet to go with this activity.

**Badge/ Banner Competition:** Pupils can compete to design badges/ banner which best represent their understanding of air quality. The winning badge could be made into a design for air quality champions to wear. Banners displayed at school gate.

b) Pupils could research further information to inform their actions e.g. about air pollution and its impacts
# Task 6
Evaluating Success

<table>
<thead>
<tr>
<th>Guidance Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td><strong>CFE Outcomes</strong></td>
</tr>
<tr>
<td><strong>Timescale</strong></td>
</tr>
</tbody>
</table>
# Task 6
Evaluating Success

## Instructions

| a) | After the actions have been completed, discuss with the class:  
|    | - Do they think their actions have achieved their aims?  
|    | - How do they know?  
|    | - How could they find evidence that their actions worked? |
| b) | As a class, look at the suggestions that groups made during Lesson 4 and discuss these.  
| c) | Evaluating success will depend on the action taken. Examples include:  
|    | - Survey pupils to see if any more are walking, cycling, scooting or travelling to school by Park & Stride.  
|    | - Survey routes of travel to school to see if more pupils are using walking and cycling routes to avoid air pollution hotspots.  
|    | - Consider the kinds of responses they have had from parents, the local community or other pupils to an article or leaflet.  
|    | - Re-measure air quality outside the school gate after discouraging idling cars and encouraging more pupils to travel actively to school. |
| d) | Once they have evaluated the effectiveness of their actions, they should:  
|    | - Decide how best to publicise results to the target audience.  
|    | - Plan the next steps. |
What is air pollution?
Air pollution is anything that causes the air to become contaminated with pollutants at levels harmful to our health or the environment.

What makes air dirty?
Generally, air pollution comes from the burning of fossil fuels such as coal, oil, natural gas, petrol or diesel. This happens when we use energy supplies to do everyday activities, such as cooking or washing at home and travelling by cars.

London has suffered from air pollution since the beginning of the Industrial Revolution in the 18th century. Smoke and fog together create 'smog' which makes it really hard to breathe and see clearly. More than 4000 people died in the Great London Smog in 1952! Industrial processes and domestic heating were the main contributors to air pollution in London until the 1970s.

Air pollution today
Today, when we think of air pollution, we should think of transport, especially cars. Today there are about 23 million vehicles on the road in Britain, and 20 million of them are cars! The fuel they use - petrol and diesel – cause bad gases to be ejected from the exhaust. These gases can be very dangerous for children.

Health Alert- how does air pollution affect you?
Air pollution is known to cause breathing problems, lung and heart diseases, such as asthma. Children are particularly at risk, as your bodies are less resilient and the pollutants have a more concentrated effect. Air pollution can:

- Affect your immune system, so that you can catch infections more easily.
- Make you cough, splutter, wheeze, sneeze, dizzy and it can make your eyes itch.
- Give you green snot, and more bogeys than your nostrils have space for.
- Pollution can be blamed for an estimated 200 premature deaths in the capital each year. An additional 1,200 or so serious health incidents requiring hospital admission can be attributed to pollution.

What are the pollutants?
Most pollutants are much too small to see without a microscope, but they still get into our lungs and affect our health. The main nasty pollutants in the UK are O3, SO2, NO2, PM2.5 and PM10. The most severe pollutants NO2 and Particulates including:

- NO2 (Nitrogen oxides) – NO2 also contributes to acid rain, which damages trees and the stone on buildings. You can see the effect of NO2 on a hot day in summer, when it combines with other chemicals to make the sky look heavy and brownish grey.
- Particulates (particulate matter, PM) - tiny particles of dust and soot that are released into the air. When you breathe them in, they settle in the lower parts of your lungs. There are natural sources of particulates. However, in London, the largest source of PM10 is road traffic. Lorries and diesel vehicles produce the most particulates in cities.
Everyone can help make our air cleaner!

**Actions CHILDREN can take**

- **Travel to school**
  - Walk, cycle or scooter to school! It is good exercise and can reduce air pollution.
  - Use public transport: take the bus, tube or train instead of the car.
  - If you have to travel to school by car, try car-sharing with other friends.

- **No idling**
  - If you have to be picked up by car, tell your parents not to leave the engine on while they wait for you. This is called ‘idling’ and it is a big cause of air pollution around schools. Turning off the engine could reduce air pollution and also save your parents’ money.
  - You can design signs and posters to tell people ‘no idling’ around your school.

- **Spread the word!**
  - Discuss air quality issues with your teachers, friends and family.
  - Make sure everyone you know is aware of the dangers of air pollution.

- **Simple actions at home!**
  - Energy saving actions: such as switch on equipment only when needed, set the thermostat at the lowest comfortable temperature within an average of 18°C and 21°C. These simple actions can reduce CO2 emitted which contribute to air pollution.

**Actions PARENTS & TEACHERS can take**

- **Promote sustainable travel**
  - Encourage your children and their friends to walk and cycle.
  - Encourage friends and family to walk and cycle or car-share.
  - Reduce the amount your family uses the car.
  - Discuss air quality issues with your school, friends and family.

- **If you must drive**
  - Fully inflate car tyres so your car uses less petrol.
  - **Switch the engine off** while waiting for your child after school.
  - Ensure that you have your vehicle serviced at regular intervals.
  - Try to use your car less frequently to reduce pollution, particularly for journeys under 2km.
  - Don't start your engine until you're ready to travel. Turn the engine off if you are waiting or stuck in a traffic jam.
  - Avoid rapid acceleration and heavy braking: they both increase fuel consumption and air pollution.
  - Stay within the speed limit: you use 30% more fuel to travel the same distance at 70mph instead of 50mph.
Ozone Badge Activity Sheet

How does it work?
Ozone badges are very easy to use - all you need to do is remove their seal and leave them for about 10 minutes. If you watch closely you will see the badge slowly change colour, you can then compare the final colour to the control sheet to see how much Ozone there is.

How many Ozone badges do you need?
In order to compare results with your classmates you will need between 30 and 50 Ozone badges for your whole school. These need to be collected from different locations (such as your school playground, a road and a park near the school) and at different date and times (such as morning, lunch time and afternoon).

How to organize your pupils:
Pupils should divide into three groups: morning, noon and afternoon. Each group will spend 1 to 1 and a half hours visiting different locations: school, roads and parks. You will need to spend about 20 minutes at each location to give 10 minutes to expose badges and 10 minutes to compare colours and record the data.
# Ozone Badge Record Form

**School:** ____________________  **Date:** ______________  **Weather:** ______________

**Group:** □ Morning  □ Noon  □ Afternoon  

**Participants:** __________________________________________

## Location 1: School

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Exposing Time (10 minutes)</th>
<th>Sample Code</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>School –1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>School –2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>School –3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>School –4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>School –5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Location 2: Road/ busy main street

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Exposing Time (10 minutes)</th>
<th>Sample Code</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Road – 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Road – 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Road – 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Road – 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Road – 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Location 3: Park/ green area

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Exposing Time (10 minutes)</th>
<th>Sample Code</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Park – 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Park – 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Park – 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Park – 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>::</strong></em> to <em><strong>::</strong></em></td>
<td>Park – 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Peppered Moth Activity Sheet

*Air pollution affects not only people but also plants and animals. The Peppered Moth is a good example that students can learn air quality and air pollution!*

**The Peppered Moth**

The Peppered Moth is widespread in Britain and Ireland and is frequently found in back gardens. It is one of the best known examples of evolution by natural selection, Darwin's great discovery, and is often referred to as 'Darwin's moth'.

**The Peppered Moth and Air Pollution**

Peppered Moths are normally **white** with **black** speckles across the wings, giving it its name. Originally, the peppered moths wing colours camouflaged them against the light-coloured trees and lichens that they rested on.

However, in the nineteenth century, during the Industrial Revolution in England, widespread pollution killed off lichens and blackened urban tree trunks and walls. Therefore the normal, pale, speckled forms of the Peppered Moth were no longer camouflaged from predators on the soot-blackened trees. Black Peppered Moths thrived in these situations and the normal pale form became rare. Over successive generations, the black moths came to outnumber the pale forms in our towns and cities.

In the mid-twentieth century controls were introduced to reduce air pollution and as the air quality improved tree trunks became cleaner and lichen growth increased. As pollution has been greatly reduced, the balance swung back the other way.

**Peppered Moth Activities**

- **Key Message**: White peppered moths indicate less pollution, better air quality
- **The peppered moth story**: Tell students about the story, including the relationship between the moth and air quality, its evolution in UK history.
- **Observation**: Ask pupils if they have seen moths before? Are they peppered moths? What colour are they? Encourage pupils to observe moths in school, gardens, parks, and other places they visit.
- **Moth competition**: It can be an activity to promote sustainable travel. Get your class to draw and cut out a big black moth. Each member of the class can make an air quality pledge eg to walk or cycle to school. Each morning the class can put a white dot on the black moth if they have done their pledge until covered in white dots. It can be competition between classes in your school, or between groups in one class.


Peppered Moth Pledges Sheet

My name is

My pledge to improve air quality is

My name is

My pledge to improve air quality is

My name is

My pledge to improve air quality is

My name is

My pledge to improve air quality is

My name is

My pledge to improve air quality is

My name is

My pledge to improve air quality is