Clean air for better breathing

Resource Kit for Primary Levels

LESSON PLANS
INTRODUCTION

Clean Air for Better Breathing brings together knowledge and resources from both the AirWatch and Asthma Friendly Schools programs to provide schools with learning opportunities to link concepts about the environment and health, and better understand the relationship between air quality and respiratory health (in particular asthma).

Clean Air for Better Breathing objectives:
- to raise awareness among the school community of the relationship between air quality and respiratory health (particularly asthma)
- to increase school community understanding and willingness to adopt practices which improve their local air quality and reduce asthma triggers.

These lesson activities are supported by resources available on the South Australian Environment Protection Authority and Asthma Foundation of South Australia websites:
- www.epa.sa.gov.au
- www.asthmasa.org.au

Acknowledgements

Air quality content (with the exception of the audit tool activity) has been adapted with permission from ‘Who Cares About Our Air- a workbook on air pollution for Primary Schools’, written and compiled by Jennifer Anderton and Gabrielle Robertson, Western Australian Department of Environment and Conservation.
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Air is made up of a mixture of gases, some of which are essential for life:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Percentage</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N₂)</td>
<td>78%</td>
<td>inert gas</td>
</tr>
<tr>
<td>Oxygen (O₂)</td>
<td>21%</td>
<td>used for respiration by plants and animals</td>
</tr>
<tr>
<td>Argon (Ar)</td>
<td>~1%</td>
<td>inert gas</td>
</tr>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td>~0.03%</td>
<td>used by plants to make their own food</td>
</tr>
<tr>
<td>Trace gases</td>
<td></td>
<td>methane, oxides of nitrogen</td>
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Water can exist in our air in varying amounts as a gas and comes from evaporation from water bodies, rainy weather or be given off from plants during the day. Humidity is determined by the amount of water vapour in the air. The air also contains tiny particles such as dust, sea salt, volcanic ash and soot, all of which are small enough to float in the air.

A **mixture** is where different substances are mixed together but do not interact with each other. For example, muesli is a mixture with different components which can be separated.

A **compound** is where different substances have interacted to form a new substance and cannot be separated into their separate parts again. For example, the ingredients in a cake.
# LEARNING ACTIVITY 1: THE AIR WE BREATHE

## KEY MESSAGE: Air is important for the survival of people, plants and animals

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<td>1. People need air to live</td>
<td>Have a class discussion about what things we need to stay alive (food, water, air). Show slide ‘Essentials for Living’ and ask the class how long we can live without each of these. Talk about how long we can go without air before our life is threatened – relate this to asthma.</td>
<td>‘Essentials for Living’ slide</td>
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<td>2. Clean air is a valuable resource</td>
<td>Ask students to make a list of all the things for which we need air. Students then to read out their lists of reasons why we need air, and make a class list. Some expected responses may be:</td>
<td></td>
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<td>- people need air to breathe</td>
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<td></td>
<td>- sound needs air to travel</td>
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<tr>
<td></td>
<td>- plants need air to make their food</td>
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<tr>
<td></td>
<td>- fires need air to burn for cooking and heating</td>
<td></td>
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<tr>
<td></td>
<td>- cars need air to burn petrol</td>
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# LEARNING ACTIVITY 1: THE AIR WE BREATHE

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<tr>
<td><strong>3. Air is made up of a mixture of gases</strong></td>
<td>This activity enables students to ‘visualise’ air, helping them to realise that air is not homogenous but made up of different types of molecules which do not interact. It also highlights the difference between a compound and a mixture. In groups or as a whole class, in a glass jar, make the following mixture using the following recipe. Stir to mix well.  78 dried peas (represents nitrogen gas) 21 lima beans (represents oxygen gas) 1 popcorn (represents carbon dioxide) 1 raisin (represents water vapour) 1 fruit loop (represents trace gases) 1-3 ribbon pasta (pollutants)</td>
<td>Class discussion:  This is called a mixture. How would you describe a mixture? How is this mixture different to the ingredients in a cake? This mixture in your jar represents the gases which make up our air. Looking at the mixture, which is the most abundant gas in the air? Which of these gases is important to our survival? (Oxygen) Why? (We need it to breathe). Does it make up most of our air? (No) The amount of oxygen in the air is always about the same. What keeps it that way? (The gases are recycled in the air by plants to animals). Predict what might happen if the amounts of these gases changed.</td>
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<tr>
<td><strong>4. Air pollution can effect how we live</strong></td>
<td>Show students various images of air pollution. Ask students to write about how they would feel living in a city that has air pollution of the sort shown in the images. Discussion with the class:  What problems might you experience living in air shown in these images? How would you feel if you had to live in this sort of air all the time?</td>
<td>‘Air Pollution Images’ slides</td>
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WHERE DOES ASTHMA OCCUR?
Refer to the slide ‘Where Does Asthma Occur?’

Asthma occurs in the small airways (called bronchioles) in the lungs. The thickness of the bronchioles is approximately that of a human hair (1/2 mm in diameter). Imagine the significant affect that reducing the passage of air through such small airways could have.

**Our Respiratory System:** The pathway of the air we breathe

**Breathing in:**
1. by tightening the diaphragm muscle (under the lungs) air enters the body through the nose (filtered and warmed) and mouth
2. goes through our largest airway, the trachea (windpipe)
3. branches into left and right bronchi and enters the lungs
4. further branches into smaller bronchi
5. branching continues to smaller airways – bronchioles (blow up diagram)

**THIS IS WHERE ASTHMA OCCURS**
6. bronchioles to alveoli (air sacs at the end of the airways – round shapes in blow up diagram).

**Breathing out:**
Relaxing of the diaphragm expels air from the body – reverse of above.

Oxygen in the air enters the bloodstream through the alveoli and is distributed throughout the body to ‘fuel’ our cells.
### LEARNING ACTIVITY 2: ASTHMA AND OUR BODY

**KEY MESSAGES:** People breathe air into their body through their respiratory system

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| 1. Asthma occurs in the small airways of the lungs. Our lungs are part of our respiratory (breathing) system | Class Discussion:  
Where are our lungs?  
What do the lungs do? (take oxygen from the air we breathe and distribute this throughout the body via the bloodstream, ‘feeding’ our cells)  
What could happen if you can’t breathe properly?  
Show the slide, ‘Where Does Asthma Occur?’ and relate to discussion  
Describe the airways in the lungs as being like the branches of a tree, getting smaller and smaller towards the outside (optional activity: go outside to observe a tree noting size of branches getting smaller). The airways in our lungs branch out like this getting smaller and smaller. The small airways where asthma occurs are like the thin twigs near the leaves of a tree.  
Provide a copy of the ‘Asthma and Our Respiratory System’ activity sheet to each student.  
Students cut and paste or draw the body parts onto the body outline, labelling each line with the nearest part.  
Have students complete the asthma word substitute by placing words from the list in the underlined spaces. | Slide: Where does Asthma Occur?  
Activity Sheet 1: Asthma and Our Respiratory System |
There is great concern over poor air quality as it can contribute to health problems in our community, especially for the very young, the elderly and those with existing illnesses. People with asthma have more sensitive airways, their lungs responding more strongly to the effects of pollutants in the air. More information about the health effects of particular pollutants can be found in the teaching notes for Learning Activity 4. This Learning Activity focuses on one type of air pollutant, particulate matter, and its relationship to health.

Particulate matter (also called PM), are small particles of tiny solids or drops of liquids that can enter the air from both natural and human-made sources. Natural sources include bushfires, dust storms and pollens while human-made sources include motor vehicle emissions, incinerators and wood heaters. With time, PM settles on the ground or on surfaces or is washed out of the air by rain.

When particles are breathed in, they can cause health problems, especially in the very young, the elderly or people with lung or heart disease. Very small particles make health problems like bronchitis, emphysema and asthma worse.
LEARNING ACTIVITY 3: AIR AND HEALTH

KEY MESSAGES: Air pollutants and allergens can impact on human health, particularly for sensitive groups within the population, including the elderly, people with existing illnesses (for example, asthma) and children.

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<tr>
<td>1. Particles in the air, when breathed in, can cause health problems.</td>
<td>Provide a copy of the ‘Particles and Health’ activity sheet for each student. This activity will require students to use the library or have access to reference books on the respiratory system. Answers to Activity Sheet 2 – ‘Particles and Health’: What does the respiratory system do for us? (Helps us get oxygen into the body and remove the carbon dioxide) What is the important gas which gets into our body via this system? (Oxygen) What gas leaves the body this way? (Carbon dioxide) Draw arrows showing the paths the particle can take to get into your lungs. (See diagram) Have a class discussion asking the following questions: Why is oxygen important to our body? (It burns our food to give us energy) Why do we breathe faster when we've been running? (More energy is required) Why do you think some particles get past the hairs in our nose and throat? (They are too small to be caught) Give at least three reasons why particles entering the lungs can be bad for you. (Makes old and young people sick, can cause respiratory conditions to get worse.</td>
<td>Activity Sheet 2: Particles and Health</td>
</tr>
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</table>
The **visible pollutants** we call particles (or particulate matter) are tiny particles of solid or drops of liquid which float in the air. (See previous notes on particles and health).

**Invisible pollution** is made up of gases which mix with air and, at times, even react with it to form other gases. Examples include invisible gases from car exhausts.

**Types of pollutants:**
There are hundreds of pollutants that float around in the air that we breathe. Australia has established National Air Quality Standards for six of these pollutants: ozone, carbon monoxide, nitrogen dioxide, particulate matter, sulphur dioxide and lead. These air quality standards are designed to protect the health and welfare of people, plants and animals, and to protect our water, buildings, monuments and other resources.

**Ozone:**
Ground level ozone (different to ozone which is a natural part of the upper levels of the atmosphere) forms in the air when pollutants known as volatile organic compounds (VOCs) and nitrogen oxides (NOx) mix together. Ozone is often invisible to the naked eye. The higher the temperature and the more direct the sunlight, the more ozone is produced. In large Australian cities this tends to happen in late spring, during summer and early in autumn when there is lots of sunlight, high temperatures and calm weather. The effects of ozone include eye, nose and throat irritations, damage to our respiratory tracts, chest tightness and wheezing. There is also evidence that ozone can increase our sensitivity to allergens, trigger asthma attacks and increase our susceptibility to infection.

**Carbon monoxide:**
This is a colourless, odourless and very toxic gas, which comes from incomplete burning, industrial processes and biological decay. Motor vehicles contribute 80% of the carbon monoxide. Other sources may come from our homes, gardens, schools, shops and service stations contribute 18% while industry only accounts for 2%. One of the most significant individual sources of carbon monoxide is cigarette smoke. Low levels of carbon monoxide can reduce our ability to carry out exercise. Greater levels reduce our ability to concentrate and cause headaches. Very high levels can be fatal.
Oxides of nitrogen:
The most common of these are nitric oxide and nitrogen dioxide. These help form photochemical smog and also have significant impacts on health. The largest human-made source of nitrogen oxides is the combustion of fossil fuels, mostly from motor vehicles and industry. While nitric oxide is relatively safe, it is converted into nitrogen dioxide in the atmosphere. At certain levels, nitrogen dioxide can affect our respiratory system and increase our susceptibility to infection. This is a real problem for infants, older people or for those people with problems such as bronchitis and asthma. There is evidence that nitrogen dioxide can trigger asthma attacks and long term exposure can irreversibly damage our lungs.

Particulate matter:
Also called PM, these are small particles of tiny solids or drops of liquids that can enter the air from both natural and human-made sources. Natural sources include bushfires, dust storms and pollens while human-made sources include motor vehicle emissions, incinerators and wood heaters. With time, PM settles on the ground or on surfaces or is washed out of the air by rain. When particles are breathed in, they can cause health problems, especially in the very young, the elderly or people with lung or heart disease. Very small particles make health problems like bronchitis, emphysema and asthma worse and can cause ‘premature’ death. These particles can also bring in carcinogens with them when they enter the body.

Sulphur dioxide:
This is a colourless, irritating and reactive gas with a strong odour. In Australia, sources of sulphur dioxide come primarily from industrial operations that burn fuels such as coal, oil, petroleum and gas, and from wood pulping and paper manufacturing. It is also emitted from motor vehicles. Sulphur dioxide irritates the eyes, nose and throat, and people with impaired lungs or hearts and asthmatics are particularly at risk of exacerbating existing health problems.

Lead:
Is a soft bluish white silvery grey metallic solid and can be released into the air from industry and the burning of fossil fuels or waste. There has been decreasing levels of lead in Australia’s air since the introduction of unleaded petrol in 1986 and the phasing out of leaded petrol which was completed in 2002. Lead levels in major cities and towns are now very low, however lead remains a problem where smelters are located close to urban areas. Lead can affect almost every organ and system in the body. Exposure to high levels of lead can affect the nervous system, brain and kidney function as well as a child’s mental and physical development.
LEARNING ACTIVITY 4: AIR POLLUTANTS AND THEIR SOURCES

KEY MESSAGES: Substances from a variety of sources (natural or from human activities) can be added to the air contributing to poor air quality both outside and indoors including:

- wood smoke (from domestic heaters and bush fires)
- industry emissions
- chemicals (for example, perfumes and cleaning products)

(most of these substances can be titled as sources of ‘air pollution’ while pollen, for example is more often known as an ‘allergen’)

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<td>1. Pollutants in the air can be either visible or invisible.</td>
<td>Provide students with the ‘Visible and Invisible Pollutants’ activity sheet. Explain to the students that the bowl of water represents a model of the air, the milk represents gaseous air pollution and the pepper represents particles in the air. Students will observe the differences between the reactions of the milk and the pepper when put into the water. They will observe how long it takes the pepper to settle to the bottom. Discuss the results with the class. If this is done as a demonstration, using a clear glass bowl instead of a clear cup, it helps to have a light or white paper behind the bowl so the pepper is easier to observe. Answers to activity questions: 1. Gases 2. Particles (particulate matter) 3. Pepper (In a controlled area, particles can be removed by filtering the air. Removing gases from the air is more difficult. Some gases can be removed by using industrial ‘scrubbers’ (devices that can be used to remove some particles and gases from industrial exhaust streams). Have a class discussion, asking the following questions: In winter we can often see a brown ‘smudge’ over the city or in the distance. What do you think this is? (Particles in the air) What can cause particles to be present in the air? (Wood fires, burning off, car exhaust) Cars put lots of pollutant gases into the air. Can you always see them? (No) Why not? (They are invisible)</td>
<td>Activity Sheet 3: Visible and Invisible Pollutants Water Clear plastic cups or bowls Teaspoons Milk Pepper</td>
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## LEARNING ACTIVITY 4: AIR POLLUTANTS AND THEIR SOURCES (cont’d)

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</table>
| 2. There are many different types of pollutants        | Role play: hand out the ‘Types of Pollutants’ activity sheet Part 1 to participating students (there are 8 characters in the role play, but ‘the gremlins’ can be cast singularly or as a group of actors so that the whole class can have an opportunity to participate).  
Hand out the ‘Types of Pollutants’ activity sheet Part 2 and ask students to fill in the table from the information given in the play. | Activity Sheet 4, Part 1 and Part 2: Types of Pollutants                     |
TEACHER’S NOTES
LEARNING ACTIVITY 5: ASTHMA TRIGGERS

Although we don’t know what causes asthma, we do know that under certain circumstances the airways react and asthma symptoms develop. We refer to the stimuli that can lead to asthma as ‘triggers’.

Different people react to different asthma triggers and many people with asthma react to a variety of triggers. Asthma may develop from exposure to one trigger or from a number of triggers simultaneously (e.g. a student with a cold goes into a change room where deodorant has been sprayed). For some people it is difficult to determine what triggers their asthma.

Avoiding or reducing exposure to known asthma triggers for an individual is one form of control, but is not always possible. Asthma medications can reduce the likelihood of asthma developing.

**Colds and Flu:** The most common trigger, particularly for children. When a student with asthma has a cold or the flu it is highly probable that they will develop asthma symptoms.

**Exercise/activity:** A trigger for many people with asthma. Students with asthma should be encouraged to take part in school based exercise and physical activity to contribute to their cardiovascular fitness and their general well-being. People with asthma should be able to participate in almost any sport or exercise. Most individuals with Exercise Induced Asthma can exercise to their full potential if the condition is properly treated. Many top athletes competing at national and international level have asthma. Scuba diving is the only activity not recommended for people with asthma.

Exercise is an important part of health and fitness and should be encouraged for all children. Children whose asthma is affected by exercise should have a written Asthma Action Plan completed by their doctor to help minimise and prevent asthma symptoms. Exercise induced asthma is common and can be more of a problem when other asthma triggers are present, eg. if a student has a cold or flu, on cold days, or when high levels of pollen or pollution are present.

Although asthma can develop during exercise, exercise induced asthma is also likely in the period directly following the activity.

**Smoke:** As well as active and passive cigarette smoke, woodsmoke from open fires, burn-offs or bushfires can trigger asthma.

**Pollens/moulds:** Pollens from flowers, grasses and weeds carried in the air are difficult to avoid, particularly in spring and summer. At times, staying indoors is the best measure. The airborne spores of moulds may be encountered in wet areas of houses as well as in mulch, potting soil, compost and leaf litter.

CONTINUED OVER
Clean Air for Better Breathing

Teacher’s Notes

Learning Activity 5: Asthma Triggers (cont’d)

Animals/pets: Animal hair, skin (dead flakes), urine and saliva may trigger asthma. Major source is cats and dogs (sweat and saliva); other animals include guinea pigs, birds, mice & rats, rabbits and horses.

Changes to weather/air temperature: Changes in air temperature in the order of 10 degrees (either way, cold to hot or hot to cold) can aggravate asthma, e.g. moving from a heated classroom to cold outdoors. Significant shifts in weather can have the same affect. It is the change of temperature of the air entering the lungs and passing through the airways that can trigger asthma.

Dust and dust mites: Dust in the air, particularly on hot, dry and windy days, and household dust that may become airborne from ‘dusting’, sweeping or vacuuming can bring on asthma. Dust mites are microscopic creatures that are a common asthma trigger. Dust mites tend to be prevalent in carpets and bedding, liking moist conditions and feeding on shed skin. Stuffed toys can be a source of dust mites.

Deodorants/perfumes: Personal hygiene products can be a trigger for asthma, including perfumes, after-shaves, hair sprays and deodorant sprays. Some schools have banned the use of anti-perspirant deodorant sprays, even in sports change rooms.

Chemicals: Certain strong smelling household chemicals can trigger asthma, including paints, adhesives, ammonia and bleach. Strong smelling chemicals used in the classroom, e.g. glue, can trigger asthma – it is worthwhile to consider ventilation options that may help overcome this.

Foods/additives: Fairly rare and usually affects very young children, but reactions can be extreme and even life-threatening. Triggers can be peanuts, shell fish, dried fruits (sulphur dioxide), mono sodium glutamate (MSG) and yellow food colouring (Tartrazine 102).

Certain medications: Medications known to trigger asthma include aspirin, anti-inflammatories (non-steroidal, e.g. ibuprofen) and beta blockers (used for heart conditions and high blood pressure). A person with asthma should always ensure that the Doctor or pharmacist is made aware of their asthma when considering a new medication and monitor themselves for any asthma signs.

Emotions: Emotional reactions such as laughter, crying, excitement and stress related can trigger asthma. For students, stress from the pressure of exams is a known factor.
## LEARNING ACTIVITY 5: ASTHMA TRIGGERS

**KEY MESSAGES:** People with asthma have sensitive airways in their lungs, and when exposed to certain triggers their airways narrow, making it hard for them to breathe; Air pollutants and allergens can act as a trigger for people with asthma (air quality related triggers include smoke, pollens, moulds, dust, deodorants/perfumes and chemicals).

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<tr>
<td>1. Asthma can be started by different triggers</td>
<td>Have a class discussion asking the following questions: What can make you feel breathless? What things do you think could start someone’s asthma? Things that start someone’s asthma are called ‘triggers’. What are the ‘triggers’ for people you know who have asthma? Where might you find or come across these triggers? Provide a copy of the ‘Trigger or not a Trigger’ activity sheet for each student. Help students to identify the asthma triggers for them to label and colour in. Ask which asthma trigger is good for a person’s health? (exercise) Explain that people with exercise as a trigger for their asthma have medication so that they can exercise and be fit and healthy like everyone else.</td>
<td>Activity Sheet 5: Trigger or not a trigger</td>
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<td>2. Some asthma triggers can be avoided</td>
<td>Use the information in the ‘Teacher’s’ Notes: Asthma Triggers’ to talk about each asthma trigger – where you would come across them and how someone could try to avoid them if they were a trigger for their asthma. Students form groups of 3 or 4 and are provided with one of the 8 Trigger Scenarios (Activity Sheet 6). Students identify the trigger in the scenario and answer the questions on their Trigger Scenario. Groups report their findings to the class. Show the class images of air pollution and discuss the asthma trigger issues for each.</td>
<td>Activity Sheet 6: Trigger scenarios</td>
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LEARNING ACTIVITY 6: AIR AND ASTHMA ACTION

KEY MESSAGES: Actions can be undertaken to reduce air pollutants and allergens within the school environment to improve the quality of air and minimise asthma triggers. When someone has an asthma attack they may need help to take asthma emergency medication.

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<tr>
<td>1. Asthma triggers can be controlled in some settings</td>
<td>Students form pairs and are provided with the ‘Asthma Trigger Identification Record’ activity sheet. They explore the school to identify a potential asthma trigger. Each pair completes Part 1 of their Asthma Trigger Identification Record. Write each of the asthma triggers they identified on the board. Discuss which of these triggers can be controlled by the school and examine their responses to ‘What do you think needs to be done?’ Explore what actions they could take to have these triggers controlled by the school? (e.g. write letter to Principal, School Governing Council, Student Representative Council, grounds person, cleaners; suggest a working bee to change plants). Have each pair complete part 2 of the Asthma Trigger Identification Record.</td>
<td>Activity Sheet 7: Asthma Trigger Identification Record</td>
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<td>EXTENSION ACTIVITY (optional)</td>
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<td>Identify one trigger for the class to inform the school about and agree to a process for this, identifying actions, who will be responsible and timelines</td>
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<tr>
<td>2. To gain an understanding of the air quality issues in the school’s local area that may impact on people with asthma and develop actions to improve air quality and minimize asthma triggers.</td>
<td>Use the ‘Air Quality and Asthma School Audit’ available on the websites and follow the activities.</td>
<td>Air Quality and Asthma School Audit</td>
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LEARNING ACTIVITY 6: AIR AND ASTHMA ACTION (cont’d)

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| 3. When someone has asthma symptoms they need to get help and use their asthma medication quickly. You can help if someone you know has an asthma attack. | Asthma can happen anywhere at any time. Ask the class where they spend most of their time (home and school). These are places where they know lots of the people around them.  
Ask who they would go to for help for asthma at home / at school.  
Talk about what they could do to get help for someone with asthma when they were not at home or school (use examples: shops; beach; sport venue; park; community event).  
Make a list of people they could ask for help outside of home and school (reinforce personal safety issues).  
Provide a copy of the ‘Asthma – Who Can Help’ activity sheet to each student.  
Ask students to write the name of and/or draw a picture of people who could help them in an asthma emergency in the sections on the sheet. | Activity sheet 8: Asthma – Who Can Help? |

**EXTENSION ACTIVITY (optional)**

Role Play: Students get into groups of three; they practice the following then present their role-play to the class:

Student 1 has asthma and goes up to Student 2 and says in broken speech, ‘I can’t breathe properly…please…get help’

Student 2 waves to Student 3 to get their attention; Student 3 goes over and asks, ‘Do you need help?’

Student 2 asks Student 3 for help; Student 3 asks the class, ‘Who am I?’; class guesses who Student 3 is; class gets three guesses.

Talk about what you need to tell a person so that they can help in an asthma emergency? Decide on the best answer to the question on Activity Sheet 8 and have students write/copy this into the space provided.
A collaborative project between the Environment Protection Authority and the Asthma Foundation of South Australia