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Air quality and our health

Strand

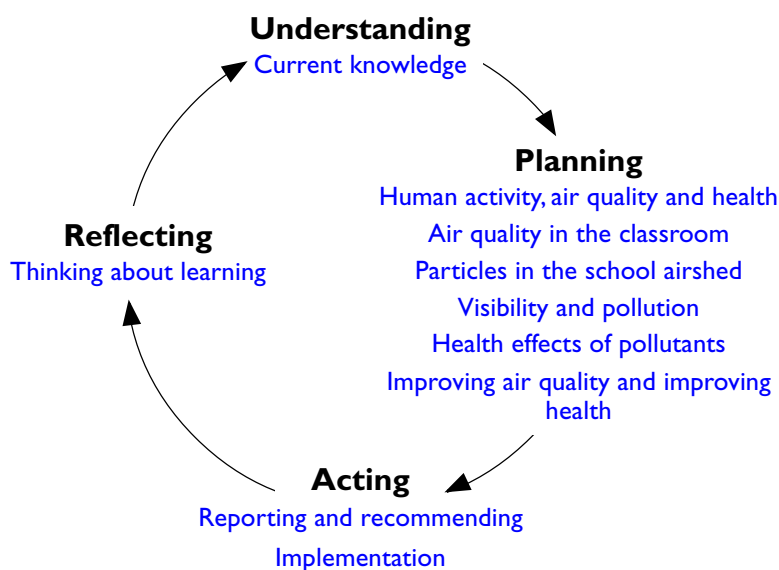
Promoting the Health of Individuals and Communities

Purpose

Students investigate ways in which the air quality in their school environment is affected by human activities. They identify the health effects of poor air quality. They develop a plan to improve air quality at school, and hence, in the long term, to reduce the number of local health problems associated with poor air quality. Students also identify the roles that they can play in implementing this plan — both as individuals and as members of the community working together.

Overview of activities

Activities in this module are based on a learner-centred approach with an emphasis on decision making and problem solving. As the following diagram shows, activities are sequenced in **understanding**, **planning**, **acting** and **reflecting** phases.



Core learning outcomes

Promoting the Health of Individuals and Communities

This module focuses on the following core learning outcomes from the Years 1 to 10 Health and Physical Education Syllabus:

- 4.1 Students recommend actions they can take to promote their health in response to social, biological or environmental factors.
- 4.5 Students identify aspects of their social and physical environments that enhance, or pose threats to, their health, and plan strategies for achieving healthy environments for themselves and others.

Core content

Promoting the Health of Individuals and Communities

This module incorporates the following core content from the syllabus:

- factors influencing health, particularly the environment and individual and group actions and behaviours;
- strategies to promote personal and community health;
- the health effects of human behaviours on social and physical environments, particularly the effects of pollution;
- the creation and maintenance of environments that promote and protect health — the role of individuals and communities.

Assessment strategy

Promoting the Health of Individuals and Communities 4.1, 4.5

The following are examples of assessment tasks that provide opportunities for students to demonstrate the core learning outcomes identified in this module.

- Students outline actions that they and their friends, family and school can take to alter human behaviour with the aim of improving the air quality in their school airshed and hence reducing the number of health problems caused by poor air quality.
 - Can the student identify an air-quality problem in the school airshed?
 - Can the student identify the possible health effects of this problem on members of the school community?
 - Can the student identify the human behaviour that has led to this problem?
 - Can the student outline actions that they or their families could take to reduce the effects of this human behaviour now and in the future?
 - Can the student outline actions that the school could take to reduce the effects of this human behaviour now and in the future?

Background information

Air quality and health

Air is all around us. It is essential for our survival and the survival of plants, humans and other animals.

Air quality is also crucial to the survival of plants, humans and other animals. Polluted air has the potential to cause many health problems, and, in extreme cases, death.

Air quality is becoming a critical environmental health issue. At present, Queensland's air quality consistently complies with recommended health guidelines. However, increasing levels of industrial activity, development and clearing of vegetation, and our continued reliance on fossil fuels and motor vehicles have the potential to increase air pollution.



In places where the air contains high concentrations of pollutants, these pollutants play a major role in causing health problems. The health problems are often area-specific because of the particular pollutants involved, and because of other environmental and social factors. (See Resource Sheet 1, 'Human sources of air pollution', for information on the source of specific pollutants, and their effects on the environment and on human health.)

Air pollution

Many people think air pollution is a problem only for big cities and overseas countries. This is not the case. Air pollution can occur anywhere. In high concentrations, air pollutants could cause health problems anywhere in Queensland, even in rural areas.

A common image of air pollution is of smoke billowing out of industrial chimneys or car and truck exhausts in large cities. While two of the major sources of air pollution in cities *are* motor vehicles and industry, domestic wood heaters are another major source. There are also many other sources of air pollution in the city, in the suburbs and in rural areas.

In suburban areas, sources of air pollution include: motor vehicles, industry, quarrying and other small mining activities, domestic wood heaters, and bushland burning (including fuel reduction burns and bushfires). Sources of air pollution in rural areas include: agricultural burning, motor vehicles (especially those travelling on unsealed roads, stirring up large amounts of dust), aerial spraying of pesticides and herbicides, domestic wood heaters, bushland burning (including fuel reduction burns and bushfires), and rubbish incineration.

There are many additional air pollutants inside the home. These can include: cigarette smoke, fumes given off by new furniture and new carpets, paint fumes, lead in the dust formed when old paint is removed, and chemicals in household cleaners and insecticides. Such pollutants can have a big impact on our health.

Airwatch Program, and using this module

This module has been based on the Environmental Protection Agency’s* *Airwatch Program*. It provides a framework for working with students to investigate local air pollution problems and their potential health effects. Its use can be extended beyond the classroom to develop a school program that:

- investigates air quality in the school and in the local area;
- takes action to reduce air pollution in the school and in the local area, and hence to reduce the eventual long-term health effects of the pollution.

*The Environmental Protection Agency was formerly known as the Department of Environment.

Terminology

Activities in this module involve use of the following language in the context of Health and Physical Education:

acid rain	emissions	pollutants
airshed	fossil fuels	sustainable
allergens	greenhouse effect	ultraviolet radiation
ambient	monitoring	
contaminant	photochemical smog	



Definitions of these terms are provided on Resource Sheet 2.

School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Social justice principles

This module provides opportunities for students to increase their understanding and appreciation of supportive environments, diversity and equity. It includes activities that encourage students to:

- recognise the school and the community as settings in which to promote health;
- understand the responsibility of communities to ensure the wellbeing and safety of individuals and groups within the community;
- explore different views on air-quality issues, and on what makes up a healthy environment;
- understand how physical structures (for example, air filters) and social structures (for example, government policy and human habits or customs) affect air quality and health at personal and local levels;
- take action to address inequities related to health and access to a healthy and safe environment.

Students with disabilities or learning difficulties may require some activities to be modified to optimise both their participation and their ability to demonstrate the outcomes. Teachers should consult with parents/carers and specialist support staff to determine whether modification is necessary.

Support materials and references

Environmental Protection Agency 1993, *Which Side of the Road?*, Queensland Government, Brisbane.

Environmental Protection Agency 1997, *Ambient Air Quality Monitoring: 1997 Annual Summary and Trend Report*, Queensland Government, Brisbane.

Environmental Protection Agency 1997, *What Is Air Pollution?*, Queensland Government, Brisbane.

Environmental Protection Agency 1998, *Air Quality in South-east Queensland*, Queensland Government, Brisbane.

Environmental Protection Agency 1998, *Airwatch Program*, Queensland Government, Brisbane.

Environmental Protection Agency 1998, *Caring for Our Air*, Queensland Government, Brisbane.

Environmental Protection Agency 1999, *Environmental Protection Agency*. Available URL: <http://www.env.qld.gov.au> (accessed April 2000).

Queensland Conservation Council 1998, *Smogbusters (Brisbane)*. Available URL: <http://www.powerup.com.au/~qccqld/smogbusters> (accessed April 2000).

Activities

Understanding

CURRENT KNOWLEDGE

Considering students' current knowledge of and attitudes to air-quality issues, as well as the knowledge and attitudes of their families and their peers; and possible solutions to air-quality problems

► Students consider common human activities that could pollute the air, and what the potential health effects of these might be.

Focus questions could include:

- What human activities may cause pollution?
- What are the pollutants produced by these activities?
- Do you know if these pollutants have any ill effects on the human body? How do you know this?
- What system in the body is most often affected by air pollutants? Why?
- How long does it take for the health effects of air pollution to show up?
- Why do the health effects of some types of air pollution become obvious only at particular times of the year or during certain climatic conditions?

Teaching considerations

For information on the sources of pollution in the city, in the suburbs and in rural areas, see Background Information. Resource Sheet 1, 'Human sources of air pollution', provides more specific examples of the sources of various pollutants and their health effects.



► Students identify air-quality problems and consider possible solutions to the problems which would lessen their health impact.

Focus questions could include:

- What are some air-quality problems that you know of?
- Do you know of any ways in which the health effects of air pollution can be reduced? If so, what are they?
- What is the government doing to improve air quality and hence protect our health?
- What is industry doing to improve air quality?
- What actions do you take to improve air quality and protect the health of yourself, your friends and family?

► As a class, students develop a questionnaire to determine local community members' knowledge and attitudes about local air quality. They then administer the questionnaire, and collate and interpret the results.

The following focus questions form the basis of the questionnaire:

- Do we have a local air pollution problem?
- Do motor vehicles cause most of the air pollution in our local area?
- Is industry the cause of most of the air pollution in our local area?
- Are there natural sources of air pollution?

- Should people be taxed more to clean up air pollution?
- Should car use be restricted in your local area?
- Should there be a limit to how much Australians use their cars?
- Should people use public transport more, and private cars less?
- Should Australians in general reduce the amount of electricity that they use?
- Do you believe that certain health problems are caused by air pollution?

Source: Questions adapted from 'Community questionnaire', *Airwatch Program* 1998, Environmental Protection Agency, Queensland Government, Brisbane.

Teaching considerations

For the class to obtain useful results, students will need to survey a sample that is of reasonable size, and also representative of the wider community (for example, the sample will need to contain males and females from all age groups, and people from different social and cultural backgrounds). Each student could survey five people from a particular focus group — for example, from a particular age group, from one gender, or from a particular residential area.

Questions could be phrased so that the answer is either 'yes', 'no', or 'don't know'. Such questions are simpler to write, and the results are simpler to analyse.

Use a discussion of the collated results to raise key issues with students, for example:

- Do the respondents believe there is a local air pollution problem?
- Do respondents believe motor vehicles or industry to be the main contributors to air pollution in the local area?
- Do respondents believe that air pollution causes health problems?
- In what ways do respondents think we should all change our behaviour to improve air quality?

► Students complete a questionnaire to determine their own knowledge and attitudes about local air-quality issues. The results can be collated, analysed and discussed as a class, or in smaller groups.

The following focus questions could be used as the basis of the questionnaire:

- What are the possible sources of air pollution — human-made and natural — in your local area?
- Are there any pollutants produced outside your local area that may affect air quality in your area? If so, what are they?
- What are the specific qualities you would like in the air that you breathe?
- If there is a brown haze in the sky over the city where you live, and you have been told that it is harmless, would you mind if the air looked that way all the time?
- If there is a brown haze in the sky over the city where you live, and you have been told that it is harmful to your health, what actions would you be prepared to take to stop the haze from forming?
- Is it worth making the changes mentioned in the previous question in order to have clean air? If so, how could this be done?
- How can people ensure that the air is kept clean now and in the future?

Source: Questions adapted from 'Class or group questionnaire', *Airwatch Program* 1998, Environmental Protection Agency, Queensland Government, Brisbane.

Planning

**HUMAN ACTIVITY,
AIR QUALITY AND
HEALTH**

Investigating the relationship between human activity, air quality, health problems caused by air pollution, and the possible solutions to these problems

R Resource
Sheets 3–7

► In groups, students analyse air-quality problems in a specified airshed for a particular scenario or scenarios (see Resource Sheets 3–7).

Focus questions could include:

- What are the air-quality problems in the scenario?
- How does each problem affect people’s health?
- What human activities or behaviour have caused each air-quality problem?
- Are there any natural features of the airshed that may influence the problem?
- What possible strategies might fix the problem and hence reduce its health effects?
- Are there other issues associated with each problem that may have an impact on the potential solution? If so, what are they?
- Will your action plan be sustainable? Explain why or why not.
- How can governments and communities overcome the problem or prevent it from occurring?

Source: Questions adapted from ‘Airshed scenarios’, *Airwatch Program* 1998, Environmental Protection Agency, Queensland Government, Brisbane.

Teaching considerations

An airshed is the air over a defined geographic area, such as a school or district. Air quality in an airshed is affected by natural factors such as topography, weather patterns, vegetation and fire, as well as by human activities, including motor transport and industry.

Note that most of the scenarios contain more than one air-quality problem.

R Resource
Sheet 2

Discuss the meaning of the term ‘sustainable’ with students (see Resource Sheet 2, ‘Definitions’).

► Students work individually or in small groups to develop an action plan to improve or maintain air quality, and hence reduce the ill effects of air pollution, in their chosen scenario(s). They present their action plans to the class for discussion.

Teaching consideration

Students could place a blank overhead transparency over a scenario map and draw an action plan on this overlay.

AIR QUALITY IN THE CLASSROOM

Investigating the air quality inside the school buildings



► Students complete a survey to find out what air pollutants might be present in their school and what the sources of these pollutants might be. A suggested survey on indoor air pollution is given on Resource Sheet 8.

Teaching considerations

Students may need help in carrying out the survey on Resource Sheet 8, as it includes questions that they may not have enough knowledge to answer — for example, about building materials, and vents on stoves.

► After completing the survey, students discuss the results as a class.

Focus questions could include:

- What is the risk of contaminant build-up in the air in your classroom?
- What is the risk that the air in your classroom contains high levels of allergens from indoor sources?
- What is the risk that the air in your classroom contains high levels of chemical pollutants from indoor sources?
- Are there any potential air-quality problems identified in the survey? If so, what are they?
- What human behaviour has led to the problem(s) identified in the survey?
- What is responsible for causing the problem(s): one pollutant or more than one?
- What are the health effects of the air-quality problem(s) identified in the survey?
- Are there any air-quality problems in your classroom that have natural causes — that is, problems that are not caused by human activities or behaviours?

► After discussing the results of the survey, students suggest ways of reducing air pollution in their classroom. The results and recommendations will be needed for producing the action plan in the last part of the ‘Planning’ phase, and for the presentation in the ‘Acting’ phase of this module.

Focus questions could include:

- What are some possible strategies for fixing the air-quality problems you have identified, and, as a result, reducing their health effects?
- Are there other issues associated with the problem(s) that may have an impact on the potential solution(s)?
- Are your suggested strategies sustainable in the long term, or only in the short term?

► Students brainstorm to produce a list of the types of chemicals that there might be in the classroom. They make a table with the list of chemicals in one column, and their sources and possible health effects in two other columns, as shown:

Chemicals in the classroom	Possible sources of these chemicals	Possible health effects of these chemicals

Teaching considerations

The following table provides a list of some of the possible indoor sources of air pollutants.

Source of pollutants	Effects of pollutants
Pesticides e.g. insect sprays	Potential short-term health effects include headaches, nausea and fatigue. There may also be long-term effects, but no causal links have definitely been established.
New furniture and freshly painted surfaces	For up to 6 months, these release chemicals that can cause headaches and fatigue in some people.
Asbestos	If asbestos is damaged, microscopic fibres become airborne. If inhaled, these can cause lung cancer or other lung problems.
Allergens from indoor sources (e.g. mould, dust mites, bacteria)	Can cause allergic reactions in some people.
The fumes from volatile organic compounds, including chemicals found in common products such as household cleaners, cosmetics, glues, nail polish, correction fluid, deodorants, etc.	The fumes from volatile organic compounds can cause problems, especially if people are exposed to high levels over a long time. Depending on the chemical, the problems may include: skin, eye, nose and throat irritation; nervous system problems, such as headaches, fatigue; and cancer. However, levels of these chemicals in the air are usually low and not harmful.

PARTICLES IN THE SCHOOL AIRSHED

Investigating particles in the school airshed and their health effects



- ▶ Students investigate the level of particles in the outside air over the school grounds. They put sticky tape on an outside window, and then lift it off. Using a microscope, they examine the particles trapped on the tape. See Resource Sheet 9, ‘The sticky-tape particle test’, for detailed instructions.
- ▶ After students have sampled the levels of particles in the air, they discuss their results as a class.

Focus questions could include:

- What did you see under the microscope?
 - Where do you think these particles came from? Why?
 - Has the weather had an impact on how the particles spread through the air?
- ▶ After discussing the results of the survey, students suggest ways of reducing particle pollution in the air over the school grounds. The results and recommendations will be needed for producing the action plan in the last part of the ‘Planning’ phase, and for the presentation in the ‘Acting’ phase of this module.

Focus questions could include:

- What are some possible strategies for fixing any problems with particle pollution in the air over the school grounds, and, as a result, reducing the health effects of this pollution?
- Are there other issues associated with the problem that may have an impact on the potential solutions? If so, what are they?
- Are your suggested strategies sustainable in the long term, or only in the short term? Explain why.

VISIBILITY AND POLLUTION**Investigating visibility in relation to pollution of the air outside the school boundaries****R** Resource Sheet 10

► From inside the school grounds or from a point close to the school, students make observations of landmarks at different times to check for differences in visibility caused by increases and decreases in air pollution. Resource Sheet 10, 'How clear is the air?', sets out details of the observation procedure for the teacher.

As a class, students discuss the observations.

Focus questions could include:

- What changes in visibility were there during the week?
- How much did visibility differ from one day to the next?
- Did the weather have an impact on visibility? If so, how?
- What is the source of the air pollution that you observed?
- What human behaviour has led to this pollution problem?
- What are the health effects of this pollution?
- Is any of the pollution from natural sources (that is, not caused by human activities or behaviours)? If so, what are the sources?

Teaching consideration

Explain to students how monitoring air quality will help with the development of strategies for reducing air pollution.

► After discussing the observations, students suggest ways of reducing air pollution in the local area. The results and recommendations will be needed for producing the action plan in the last part of the 'Planning' phase, and for the presentation in the 'Acting' phase of this module.

Focus questions could include:

- What are some possible strategies for fixing the problem of pollution in the local area, and, as a result, reducing the health effects of this pollution?
- Are there other issues associated with this problem that may have an impact on the potential solutions? If so, what are they?
- Are your suggested strategies sustainable in the long term?

**HEALTH EFFECTS
OF POLLUTANTS****Researching the health effects of the pollutants found in the school airshed and whether any of these cause health problems**

► Using the results of their previous investigations, students produce a table listing the common pollutants found in the school's airshed, the source of these pollutants, and their health effects. (They need time to research the health effects before they add the information to this column of the table.)

Focus questions could include:

- What pollutants are there in your school's airshed?
- What are the sources of these pollutants?
- What human behaviours have led to the release of these pollutants into the air?
- Has the weather had an impact on air pollution in the school airshed? If so, how?

Teaching considerations

The work in this activity is based on students' findings in the 'Understanding' phase of this module.

Resource Sheet 1, 'Human sources of air pollution', lists a range of pollutants, their sources and their health effects. Students could also use the library and the Internet to research the health effects of pollutants.



► Students conduct a classroom survey to try to find out if any class members have health problems that may be linked to the pollutants in their school airshed.

As a class, students discuss what questions to ask in the survey. They decide on the final questions and the teacher or a student records these.

Survey questions could include:

- Have you felt tired on more than one occasion at the same time of day at school?
- Have you suffered a headache on more than one occasion at the same time of day at school?
- Have you had irritated eyes on more than one occasion at the same time of day at school?
- Have you suffered an upset stomach on more than one occasion at the same time of day at school?
- Have you started to get an ear infection or sore throat on more than one occasion at the same time of day at school?
- If you experienced any of these symptoms, did they only appear at particular times of the year, week or day? If so, say when they appeared.
- If you experienced any of these symptoms, what do you think may have caused them?
- Do you think any of these symptoms you suffered may be caused by air pollution? If so, which ones? What kind of pollution do you think caused the symptoms you suffered?

► Students all fill in the surveys individually. They collate the class information, using, for example, a tally table. They then discuss and analyse the results.

Focus questions could include:

- Which symptoms were the most common?
- What may have caused these symptoms?

The results will be needed for producing the action plan in the last part of the ‘Planning’ phase, and for the presentation in the ‘Acting’ phase of this module.

Teaching considerations

Note that air pollution can have many health effects other than those mentioned in the focus questions. However, some of these effects are evident only after long-term exposure and will not be evident amongst students.

IMPROVING AIR QUALITY AND IMPROVING HEALTH

Planning ways to improve air quality in the school airshed (and consequently to improve health) by changing human behaviour

► Students consider personal actions that they can take to improve or maintain air quality in the school’s airshed, and hence reduce the ill-effects of air pollution.

Focus questions could include:

- What individual actions by students could improve the school’s air quality?
- In what ways do these actions improve air quality?
- In what ways do these actions improve health through their effects on air quality?

Teaching considerations

Suggestions on how to reduce air pollution through personal actions or changes in behaviour could include:

- If possible, take public transport or ride a bicycle to school.
- Encourage parents to maintain their motor vehicle(s).
- Use paints and glues outside in a well-ventilated area.
- Open windows regularly and frequently to allow air to circulate.
- Don’t smoke, and encourage others not to.

Further suggestions are given on Resource Sheet 11, ‘Reducing air pollution: personal action’.

R Resource Sheet 11

R Resource Sheets 3–7

► Students consider actions that can be taken by groups (for example, their class, their family, the school), to improve or maintain air quality in the school’s airshed, and hence reduce the health effects of air pollution. To prompt the flow of ideas, they could refer to the action plans they developed for the airshed scenarios on Resource Sheets 3–7. Students write their own action plans to present to the class.

Focus questions could include:

- What is the major source of air pollution in the school airshed?
- Is the source of the pollution something that is absolutely necessary to the school?
- If so, how can it be better operated or maintained to reduce air pollution?
- If this source of pollution is something that is not necessary to the school, can it just be removed? What would be needed to replace it, if anything? What are the costs and benefits of removing this pollution source?
- How can groups of people (for example, your class, your family, your school) change their behaviours or actions to reduce air pollution?
- What skills do these groups of people need to be able to make these changes?
- What support is required, and from whom, to ensure that groups of people change their behaviour in some ways to reduce air pollution?

Teaching considerations

Suggestions on how to reduce air pollution through group actions or changes in behaviour could include:

- increase use of public transport;
- encourage people to maintain their motor vehicles and drive them appropriately;
- encourage industry to implement environmentally sound practices;
- provide better facilities for travelling by bicycle;
- provide better public transport to the school;
- ban smoking indoors;
- open windows frequently and regularly to allow air to circulate;
- use paints and glues outside in a well-ventilated area;
- plant trees along the roadside to reduce problems caused by dust and noise;
- reduce backyard burning (already, many councils do not allow backyard burning).

► Students present their action plans to the rest of the class. The class discusses the plans, then chooses the one that class members believe would most benefit the health of the school community by improving or maintaining the air quality in the school's airshed.

Focus questions could include:

- Which action plan would most effectively reduce air pollution and its related health effects?
- Which action plan would be most easily implemented at your school?
- Which action plan best addresses the health issues related to air pollution?
- Which action plan would best reduce the levels of the main, or the most harmful, pollutants in the airshed?

Teaching considerations

The action plan chosen by the class should be the one that best meets all the criteria contained in the above focus questions.

An alternative way of coming up with the best possible action plan is for the class to choose the best parts from individual plans, and combine them to create an overall class plan. The class could also add extra material if required.

Acting

REPORTING AND RECOMMENDING

Presenting findings about air quality in the school airshed, and plans and recommendations for improving air quality in the school airshed

- ▶ Students in the class organise a meeting with the school principal, their own parents, and the school parents' organisation. At the meeting, they present:
 - their findings about air pollution in the school airshed (see the activities 'Air quality in the classroom', 'Particles in the school airshed', 'Visibility and pollution' and 'Health effects of pollutants');
 - their action plan recommending how individuals, families and the school community could improve the air quality in the school airshed and hence improve the health of the school community (see the final activity in the 'Planning' phase).

Students note the response of the school principal and the school parents' organisation to their presentation. This response will be needed in the following 'Reflecting' phase.

- ▶ Students write a short media release for the local newspaper about their findings and recommendations.

IMPLEMENTATION

Implementing the action plans

- ▶ As a class, students implement the action plan that they decided would most benefit the health of the school community. They decide who will take responsibility for implementing each part of the plan, and when and how it is to be done. They make any changes to their plan that may have arisen from their presentation to the school principal and the school parents' organisation.

Reflecting

THINKING ABOUT LEARNING

Reflecting on what has been learnt, and on the inquiry process used for planning how to improve air quality in the school airshed and hence improve the health of the school community

- ▶ To start the process of reflection, students recall the pollutants present in their school airshed, and the health effects of these pollutants.
- ▶ Students re-examine the results of the questionnaires that they completed themselves and that were completed by other people in the 'Understanding' phase of this module. They discuss how their own attitudes to air quality may have changed during this module.
- ▶ Looking towards the future, students consider what future action needs to be taken to keep improving the air quality in the school airshed and hence improving the health of the school community.

Teaching considerations

Some time after the implementation of their action plan, students could conduct a survey to see if the plan has been effective. (There needs to be enough time between implementation of the plan and the review to allow for measurable behavioural changes to take place.)

After carrying out the survey, students could meet with members of their community to determine what additional action needs to be taken in future to keep improving the air quality in the school airshed and hence keep improving the health of the school community. (The Environmental Protection Agency's *Airwatch Program* would be very useful here for providing ideas about other possible actions.) This process of community consultation would help students start to appreciate how community action can operate and how different members of the community play different roles in maintaining a healthy environment.

► Students brainstorm the advantages and disadvantages of using the inquiry approach to take action on a health-related issue.

Focus questions could include:

- Did the inquiry process help you find the information that you needed?
- What are the advantages and disadvantages of conducting inquiries to investigate health issues?
- Are there other ways of resolving health issues? If so, what are they?

► Students reflect on their role as change agents in influencing the behaviour or actions of other people in order to improve or maintain air quality in their school airshed.

Focus questions could include:

- What changes were made as a result of the actions taken?
- What short-, medium- and long-term impacts will the actions have on human health?
- How successful were these actions?
- Which actions were easy to implement? Were any of them unable to be implemented?
- How will individuals and groups continue to reduce air pollution and hence improve human health?
- Can this process of change continue without the support of others?
- How can individuals and groups be encouraged to participate in the change process?
- How did it feel to be able to improve the health of the school or the local community?

► After they have reflected on these focus questions individually, students could form groups to write short reports that present their combined responses to these questions. The group reports can be given to the principal, or to the next class or group in the school working on this module, or to the next class or group to take up the Environmental Protection Agency's *Airwatch Program*.

Teaching considerations

If you are teaching this material over a number of years to classes at the same level, students in one year can evaluate the actions of previous classes and build on their findings. Over time, trends will become apparent in the results your classes collect. This information provides an additional resource to enable your students to understand patterns of pollution in your local area, and their potential health effects.

Human sources of air pollution



Resource Sheet 1

AIR QUALITY AND OUR HEALTH • UPPER PRIMARY

Pollutant	Sources	Effects
Nitrogen oxides (NO _x , NO, NO ₂)	Motor vehicles (50%) Fossil-fuelled power stations	Contribute to photochemical smog and acid rain. Can cause lung disease and bronchitis.
Sulfur dioxide (SO ₂)	Burning fossil fuels (coal and oil) Smelting ores	Can irritate eyes, nose and throat. Contributes to acid rain (not a significant problem in Australia).
Carbon monoxide (CO)	Motor vehicles where fuel is not completely burnt (89%)	Causes headaches and reduces oxygen in the blood.
Particulates (dust, pollens, ash, soot)	Land clearing Fire Mining Diesel engines Vegetation	Can irritate eyes, nose and throat and harm the lungs. Discolour paint and fabrics. Reduce visibility.
Ozone (O ₃)	Formed (at lower levels of the atmosphere) when nitrogen oxides and hydrocarbons react with sunlight to produce photochemical smog.	In the ozone layer, where ozone occurs naturally, it protects us by blocking harmful ultraviolet radiation. However, at lower levels of the atmosphere, it is a pollutant that can cause breathing difficulties and harm the lungs. Ozone at lower levels is also a greenhouse gas.
Lead (Pb)	Leaded or super petrol (95%) Lead smelting	Builds up in the human body, damaging the brain and nervous system. This problem is decreasing with the use of unleaded petrol and reductions in the lead content of leaded petrol.
Hydrocarbons	Motor vehicle fuels and emissions (50%) Natural sources (e.g. vegetation) Oil-based paints Solvents, glues, cleaning agents	Contribute to photochemical smog. Some solvents can damage the liver and brain.

Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Speaker's notes', Queensland Government, Brisbane.

Definitions



acid rain	rain contaminated by natural and human-made pollutants released into the atmosphere — for example, dust, smoke and ash from bushfires and volcanoes; gases from vehicle exhausts; fumes from factories
airshed	the volume of air over a distinct geographic area within which pollutants from that area are contained
allergens	substances such as dust, pollen, mildew and animal fur, which could cause problems for people who are sensitive to them or allergic to them
ambient	completely surrounding, as in the phrase ‘ambient air’
contaminant	a substance that pollutes something else, or makes it impure
emissions	materials released or discharged into the atmosphere
fossil fuels	substances such as coal, oil and natural gas that can be used as sources of energy, and that were formed geologically from the remains of plants and animals
greenhouse effect	the warming of the Earth caused by sunlight passing through the atmosphere and being converted to heat, which is then trapped by the atmosphere. The effect is so-called because the same thing happens when sunlight passes through the glass of a greenhouse. The term is often used to refer to the accelerated warming of the Earth caused by gases in the atmosphere that have been produced as a result of human activity.
monitoring	checking, observing or measuring — for example, ‘monitoring air quality’
photochemical smog	serious air pollution, often seen as a brown haze, formed when gaseous pollutants react with sunlight
pollutants	substances that pollute the environment — for example, substances such as gases and particles released into the air that make the air dirty or impure
sustainable	able to be maintained in the present and the future without damaging the environment
ultraviolet (UV) radiation	a type of light, invisible to the human eye, emitted by the sun and some kinds of lamps. Exposure to UV light can cause skin and eye damage.

Scenario 1



In this scenario, your airshed is the air over the school grounds and surrounding roads.

The main road averages 1600 vehicle trips between 8 a.m. and 9 a.m. on weekdays (school days), 1800 vehicle trips between 3 p.m. and 4 p.m., and between 900 and 1200 vehicle trips at other times during the day.

The school population of 2000 includes preschool, primary and secondary school students, and a large staff. Only 10% take public transport, even though ample transport is available. Most students live near public transport facilities.

A high level of fine particles has been detected in the school grounds and students are developing breathing problems. Students with breathing problems cannot exercise outdoors. It is assumed that the particles are coming from the large volume of traffic.

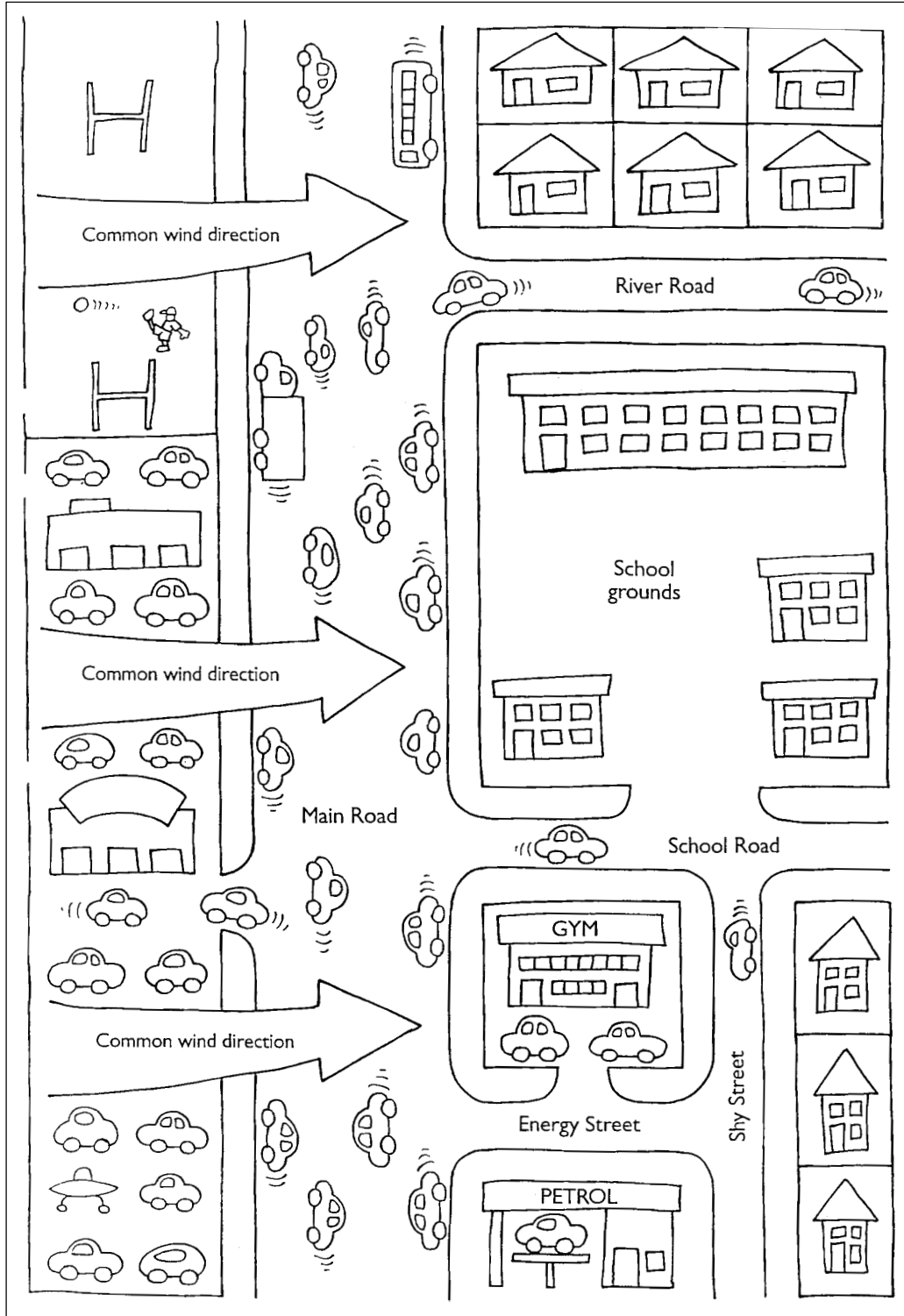
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Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Airshed scenarios', Queensland Government, Brisbane.

Scenario I (continued)



Map I



Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Airshed scenarios', Queensland Government, Brisbane.

Scenario 2

R4

Resource Sheet 4

In this scenario, your airshed is the air over the school grounds, the road and neighbouring bushland area.

Twice a year, the responsible authority backburns a bushland area to reduce fuel and decrease the risk of wildfire.

Backburning is always done during school hours, on school days, generally a week or two after school holidays.

Smoke from the fire has a strong smell and causes breathing problems for some students.

Residents are complaining that they don't know when the burning will happen and so don't know to bring their washing in and close their windows to reduce the effects of smell and ash.

The responsible authority doesn't mind when they burn, provided it is within a few weeks of the date they currently burn.

Also, dust outside the school is making children cough and giving them sore eyes when they stand outside waiting to be picked up after school. The cause of the problem is assumed to be the vehicles kicking up dust from the road.

(continued)

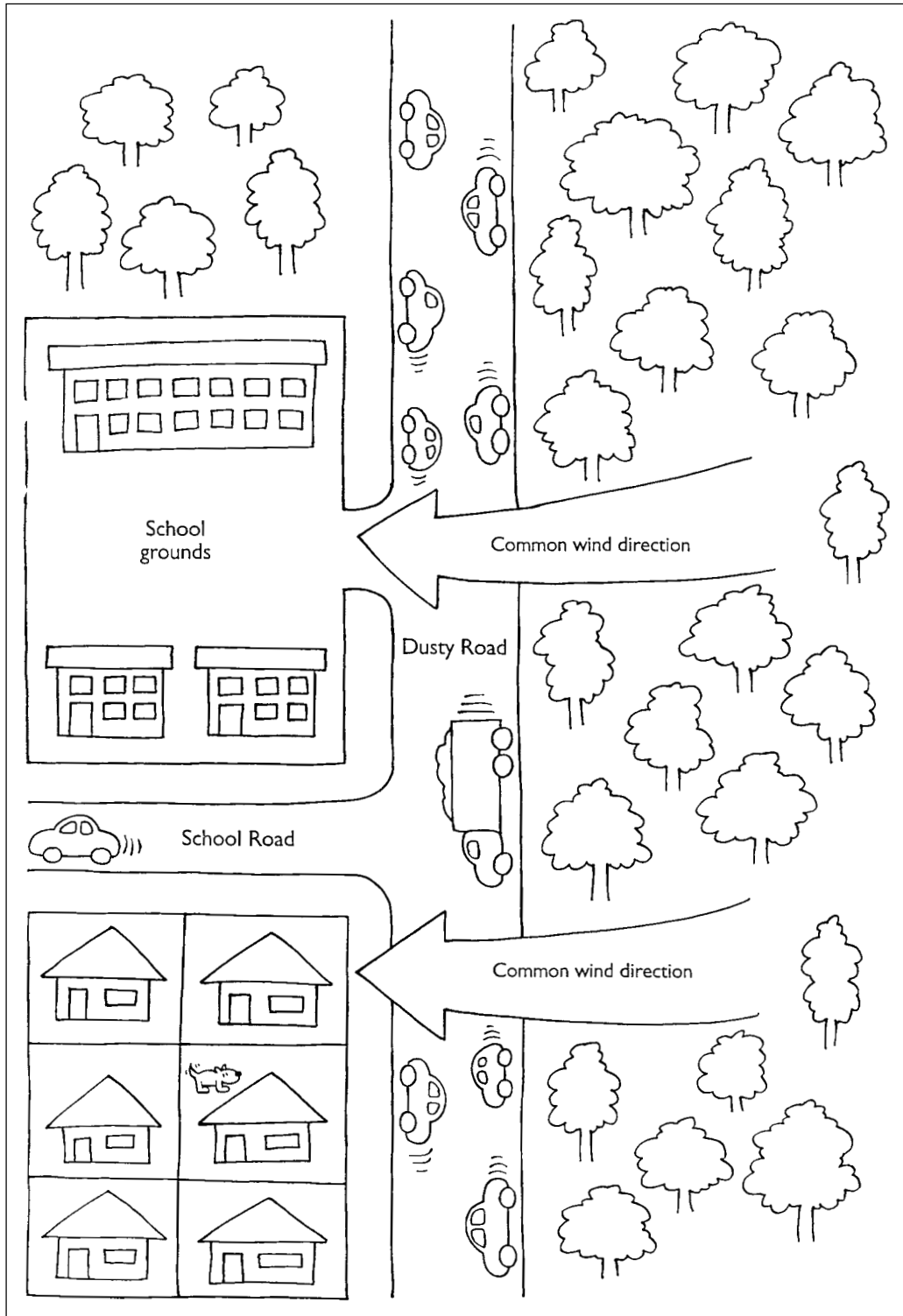
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Scenario 2 (continued)

R4

Resource Sheet 4

Map 2



AIR QUALITY AND OUR HEALTH • UPPER PRIMARY

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Scenario 3

RS

Resource Sheet 5

In this scenario, your airshed is the air over your school grounds.

At 2:15 p.m. each school day, the groundsperson burns rubbish from lunch. Wind often picks up the smoke from the fire, blowing it into classrooms and sports areas. This is causing breathing problems and a foul odour, and dangerous chemicals are being released by the burning of plastics.

The waste consists of:

- food scraps;
- plastic bottles;
- yogurt containers;
- other plastic containers;
- iceblock sticks;
- aluminium cans;
- paper wrappers.

The local council is willing to develop a recycling scheme if residents can prove that they will recycle and it will become cost-effective within five years.

(continued)

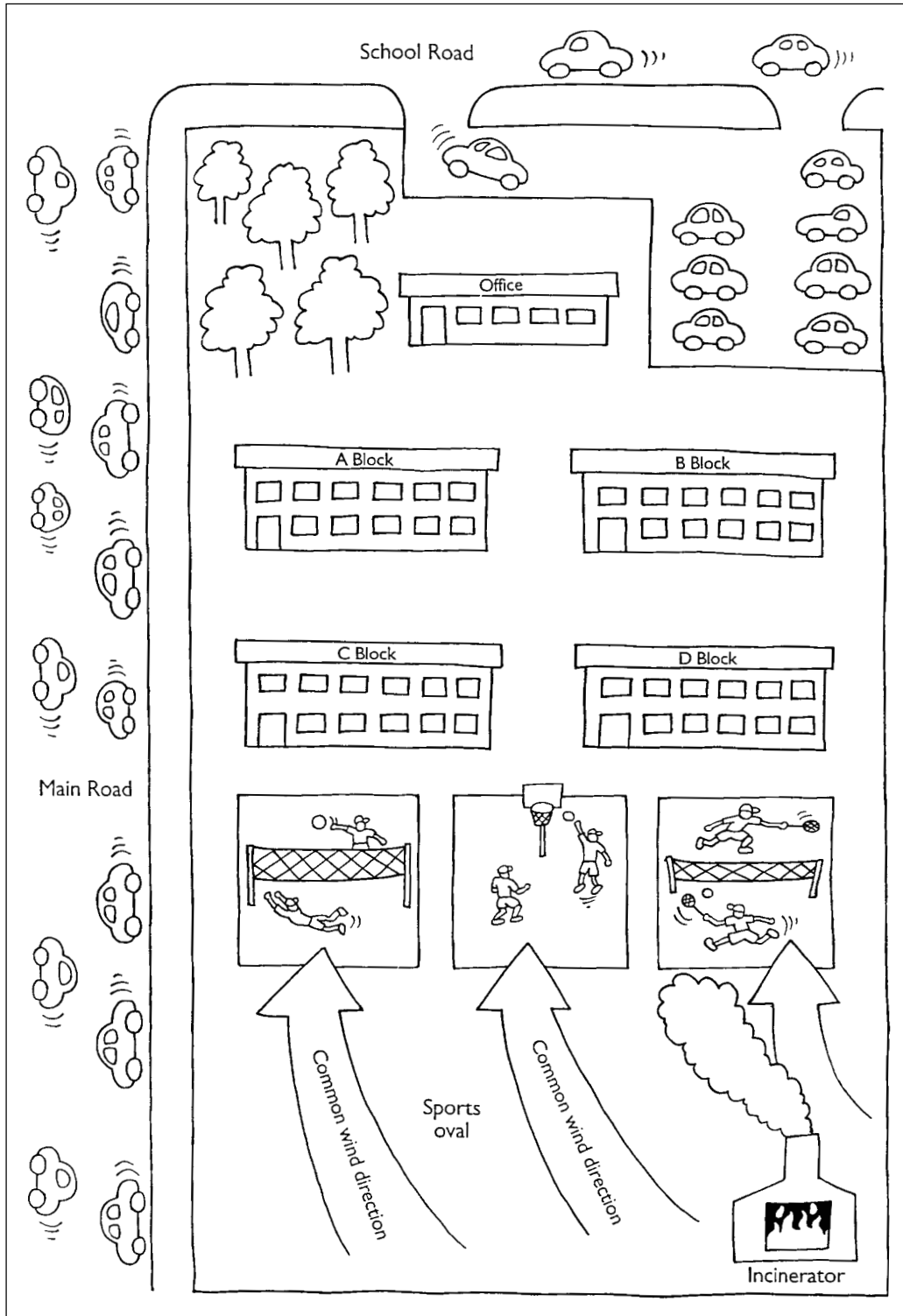
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Scenario 3 (continued)

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Resource Sheet 5

Map 3



AIR QUALITY AND OUR HEALTH • UPPER PRIMARY

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Scenario 4



In this scenario, your airshed includes the school grounds, a major industrial estate and a suburban area.

The major industrial estate releases a variety of pollutants and smoke, including nitrogen oxides, sulfur dioxide, particles, lead, carbon monoxide and hydrocarbons.

Students are starting to become irritable, tired and ill, especially those with existing breathing problems.

After students carried out a survey of the industrial estate to find out what pollutants were being released, some owners phoned the school to see where they could get more information about problems they might be causing. Others were only interested in changing their practices if it would lead to savings.

The school suffers from a high level of emissions from a busy road nearby. Ample public transport is available and accessible, but only 5% of students use it and only 2% of adults in the area use public transport to get to work.

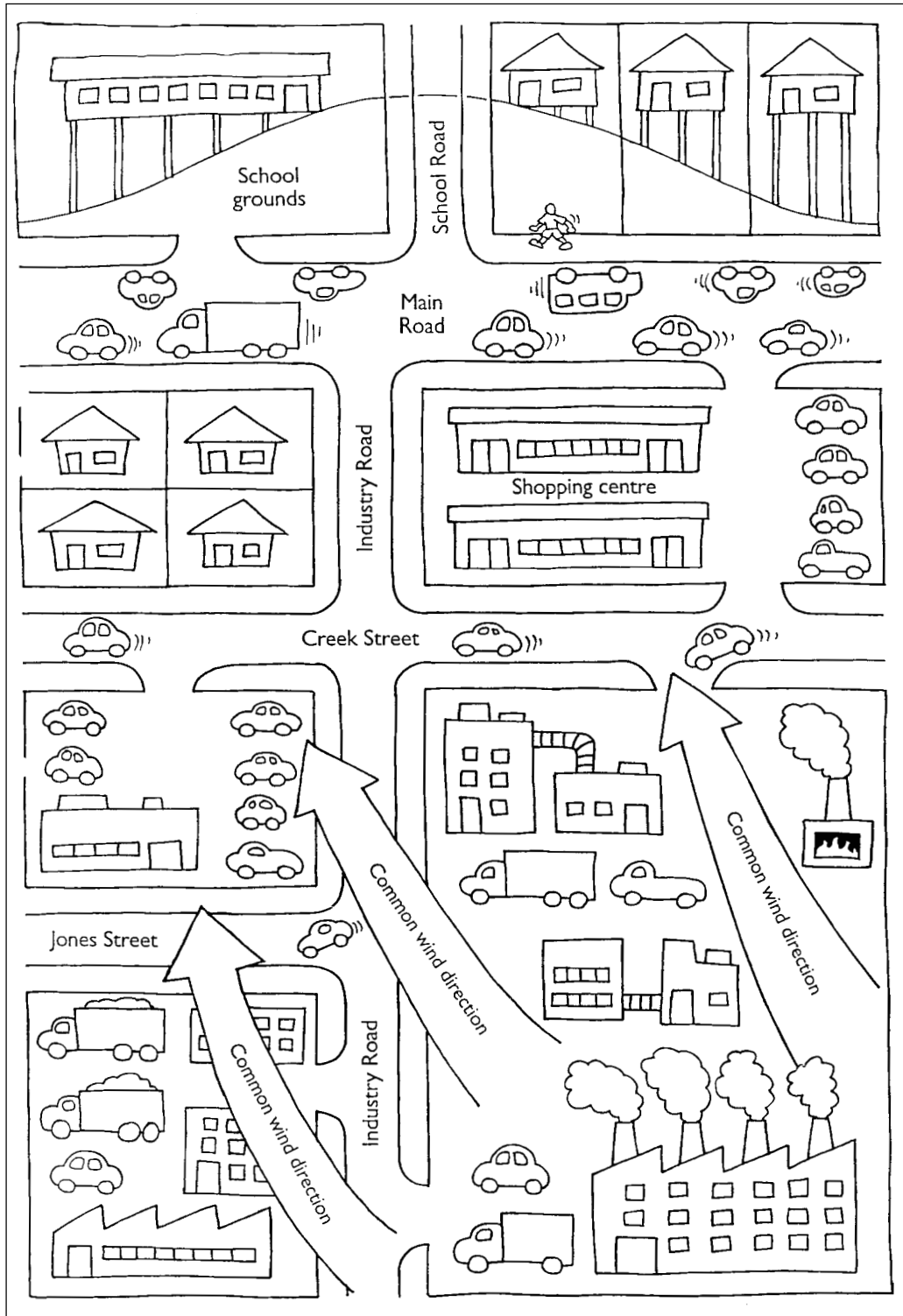
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Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Airshed scenarios', Queensland Government, Brisbane.

Scenario 4 (continued)



Map 4



AIR QUALITY AND OUR HEALTH • UPPER PRIMARY

Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Airshed scenarios', Queensland Government, Brisbane.

Scenario 5

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Resource Sheet 7

In this scenario, your airshed is the air over your school grounds, town centre and a neighbouring poultry farm.

Your school is in a country area. A survey has been carried out among residents and students to find out what the air pollution issues are in the airshed. The number one answer was the odour from the poultry farm. Second was the dust from bare soil, and third was burning off rubbish.

The town has just recovered from a mild drought, but recent rain has refilled water tanks and given plants a much-needed watering.

The poultry farm has been established for more than 50 years, but has recently increased the number of chickens and changed some of its operations. This has increased the odour.

The town is only 45 minutes from a major city, where a successful recycling program accepts aluminium and steel cans, glass bottles and paper.

(continued)

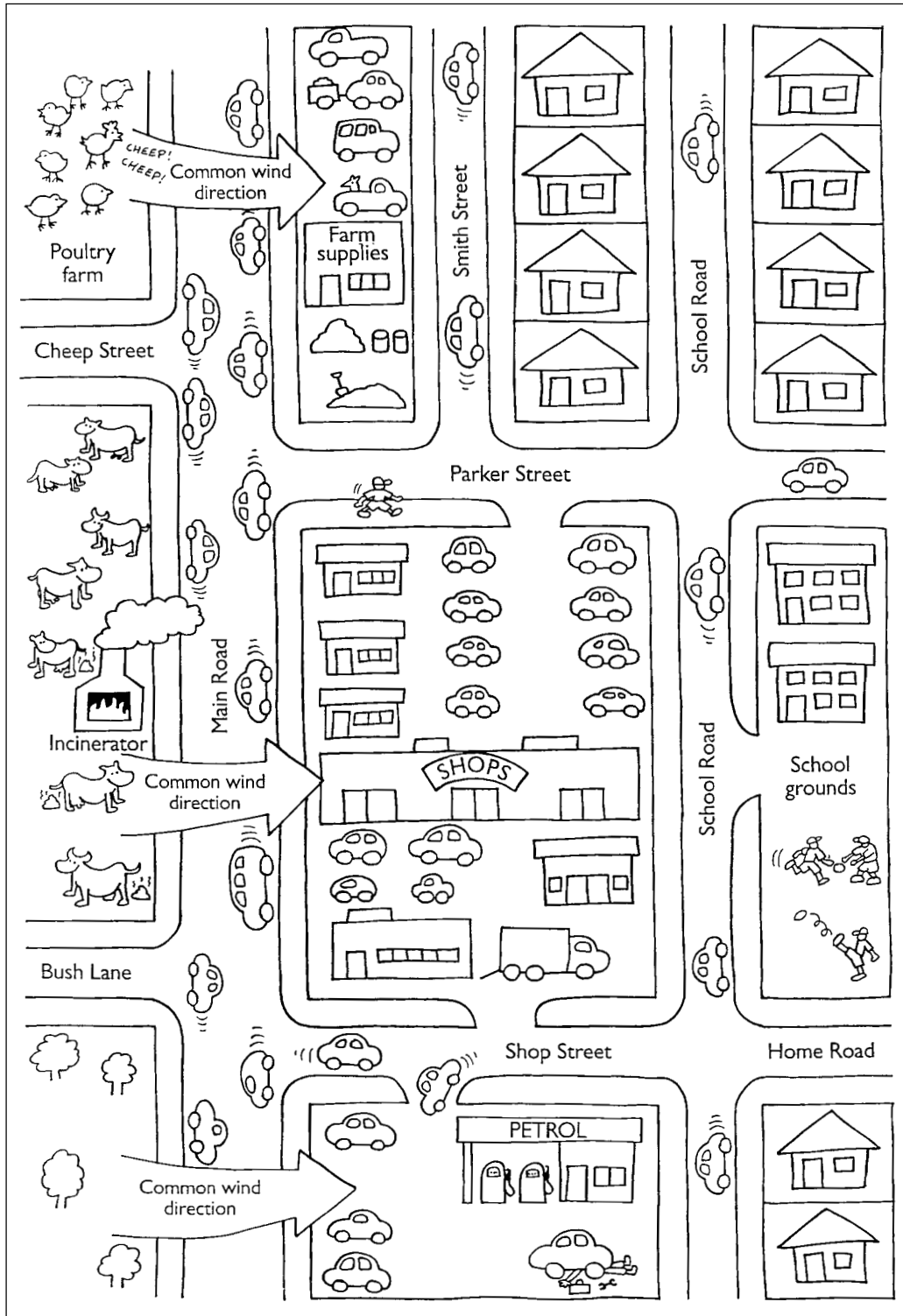
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Scenario 5 (continued)



Map 5

AIR QUALITY AND OUR HEALTH • UPPER PRIMARY



Source: Gratefully reprinted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Airshed scenarios', Queensland Government, Brisbane.

Survey: Indoor air pollution



Completing this survey will help you find out more about pollution in your classroom.

For each question, circle the number that matches your answer. Add together your scores for each section. Compare your total with the rating at the end of each section of the survey to see how clean your indoor air really is!

Section I

Potential for contaminant build-up

1. What are the outer walls of your classroom made of?
 - Brick veneer 2
 - Timber 1
 - Combination of timber and external cladding 1
 - Double brick 4
 - External cladding 1

2. What kind of foundations does the classroom have?
 - Concrete slab 4
 - Stumps 0

3. How many storeys does the building have?
 - One 3
 - Two 2
 - More than two 1

4. How high are the ceilings?
 - 2.4 m or less 2
 - Higher than 2.4 m 1

5. Are there any vents in the walls?
 - Yes 0
 - No 1

6. Do you have any of the following?
 - Draught seals on windows and on doors 3
 - Draught seals on windows only 2
 - Draught seals on doors only 2
 - No draught seals 0

(continued)

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Activity: indoor air pollution survey', Queensland Government, Brisbane.

Survey: Indoor air pollution (continued)



7. How often are windows and/or doors open in the following seasons?
(Circle one score for each of the three seasons.)

Winter

- Never 10
- Rarely 5
- Often 1
- Always 0

Summer

- Never 10
- Rarely 5
- Often 1
- Always 0

Spring/autumn

- Never 10
- Rarely 5
- Often 1
- Always 0

Rating of total score

Add your scores for questions 1–7 in Section I. See where they fit on the ratings below.

24 or less

Your classroom has adequate ventilation, and therefore there is only a low risk of contaminant build-up.

25–35

In your classroom, there is a moderate risk of contaminant build-up if sources of contaminants are present.

Over 35

In your classroom, there is a high risk of contaminant build-up if sources of contaminants are present.

(continued)

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Activity: indoor air pollution survey', Queensland Government, Brisbane.

Survey: Indoor air pollution (continued)



Section 2

Potential for high levels of allergens from indoor sources

1. What is the main type of floor covering in your classroom?
 - Carpet on 25% or more of the floor space 8
 - Carpet on less than 25% of the floor space 4
 - Hard floor (e.g. wood, tiles) 0

2. Are there any damp spots on the floor, walls or ceiling?
 - Yes 4
 - No 0

3. Is there any mould in the classroom?
 - Yes 4
 - No 0

4. Is there often condensation on the inside of any windows?
 - Yes 4
 - No 0

Rating of total score

Add your scores for questions 1–5 in Section 2. See where they fit on the ratings below.

10 or less

The air in your classroom probably does not contain many indoor allergens.

11–19

There are probably moderate levels of indoor allergens in the air in your classroom.

20+

There are probably high levels of indoor allergens in the air in your classroom.

(continued)

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Activity: indoor air pollution survey', Queensland Government, Brisbane.

Survey: Indoor air pollution (continued)



Section 3

Potential sources of indoor air pollutants

Nitrogen dioxide

1. Is a cooking appliance used in the classroom? If so, what kind?
 - No appliance 0
 - Electric stove/oven 0
 - Vented gas (with flue or chimney, rangehood) 1
 - Unvented gas (no flue or chimney) 4
 - Wood stove/oven 1

2. Does the classroom have heating? If so, what kind?
 - No heating 0
 - Electric heating 0
 - Vented gas heating (that is, with flue or chimney) 2
 - Unvented gas heating (that is, with no flue or chimney) 4

Motor vehicle exhaust

3. How far is your classroom from a busy road?
 - Less than 20 m 8
 - 21–100 m 5
 - 101–500m 3
 - More than 500 m 1

Pesticides

4. How often is your classroom treated with chemicals to get rid of pests?
 - Once a year 8
 - Every 1–3 years 7
 - Every 3–5 years 5
 - Every 5–10 years 3
 - Never 0

(continued)

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Activity: indoor air pollution survey', Queensland Government, Brisbane.

Survey: Indoor air pollution (continued)



Volatile organic compounds

5. In the past six months, have any of the following changes been made to your classroom?
- New carpet laid 6
 - Wood flooring added, or tiles attached with adhesives 6
 - Walls painted 6
 - New furniture installed 2

Rating of total score

Add your scores for questions 1–5 in Section 3. See where they fit on the ratings below.

11 or less

There is probably a low level of chemicals in the air in your classroom.

12–26

It is likely that there are moderate levels of chemicals in the air in your classroom.

27 or more

It is highly likely that there are high levels of chemicals in the air in your classroom.

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Activity: indoor air pollution survey', Queensland Government, Brisbane.

The sticky-tape particle test



Follow the procedures below to test for particles in the outdoor air over the school grounds.

Particle pollution from traffic

1. Find a window near a road.
2. Clean the window with a damp sponge or rag and then leave it alone for one day.
3. The next day, put a piece of sticky tape about 5–10 cm long on the outside of the window. (Make sure you don't touch the sticky side of the tape, or the window, with your fingers.)
4. Remove the tape, and carefully place sticky side down onto a piece of white paper.
5. Look at the sticky tape on the paper under a microscope to see what types of particles were collected.

Particle pollution from areas of vegetation

6. Repeat steps 1–5 above, but using a window near a sports oval, or some other area of vegetation.

Questions

1. Are the particles that were collected on the window near the road different from the particles on the window near the vegetation?
2. Do you think there would be any difference in how the particles from the two different places would enter the human body?
3. Do you think there would be any difference in the health effects of the particles from the two different places?

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Particle sampling', Queensland Government, Brisbane.

How clear is the air?

R10

Resource Sheet 10

Students can follow the procedure below to test visibility (that is, how far you can see) in the air outside the school grounds.

1. Choose a place within the school grounds or close to the school where students can see for a long distance into the local area.
2. Choose landmarks that are at various distances from the observation point and visible from it. Mark these on a map. Also mark how far they are from the observation point.
3. Tell students that they can either:
 - take photographs of the landmarks each day for a week, or;
 - simply make their own observations each day for a week, recording which landmarks can be seen and how well.

Students should record the weather conditions at the times photographs are taken or observations are made. (If photos are being taken, these should all be on the same roll of film, so that comparisons are not affected by possible differences between films of different brands etc.)

4. Ask students to examine the photos displayed in consecutive order, or to analyse the recorded observations. They decide whether there were any differences in visibility (or distance that could be seen) during the observation period.
5. As a class, students brainstorm why differences in visibility may have occurred. (Remember that the weather can also affect visibility.)
6. If pollution has reduced visibility, students should consider the sources of this pollution, and its health effects.

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Measuring visual air quality', Queensland Government, Brisbane.

Reducing air pollution: personal action



Personal action	How this action reduces air pollution
Transport	
Walk or ride a bicycle. Catch a bus or train to work or school. Plan car trips to minimise car use. Form a car pool with neighbours or workmates.	Motor vehicles are the main cause of air pollution in cities. They produce nitrogen oxides, lead (if using leaded petrol), carbon monoxide, hydrocarbons and particles. There are over 2 million motor vehicles registered in Queensland. By not using motor vehicles, or by reducing their use, we can reduce air pollution.
Buy a fuel-efficient car — one that is lightweight, aerodynamic, and not larger than you need.	The more fuel a vehicle uses, the more pollutants it produces. Air pollution is reduced by reducing fuel consumption or increasing the efficiency with which fuel is used.
Buy a car that uses unleaded petrol and is fitted with a catalytic converter.	Cars that use unleaded petrol do not emit lead pollution. Catalytic converters can reduce exhaust emission of carbon monoxide by 90% and of hydrocarbons by 75%.
Drive at or under speed limits.	Fuel consumption decreases by 20–25% when a vehicle is driven at 90–100 km/h compared to driving at a speed over 100 km/h.
Drive smoothly, without excessive acceleration, sudden braking and aggressive actions.	Slower, more defensive driving uses 20% less fuel than fast, aggressive driving.
Remove unnecessary weight from your vehicle.	The less the vehicle weighs, the less fuel it uses.
Remove unnecessary accessories that increase air resistance (such as roof racks when not in use).	A more aerodynamic car uses less fuel.
Keep car tyres inflated to the correct pressure and wheels aligned properly. Make sure your car’s engine is well-maintained and tuned.	Motor vehicles accelerate and stop up to 10% more efficiently with correct traction. Well-maintained and tuned cars produce significantly less air pollution because they consume less fuel and burn it more efficiently. <i>(continued)</i>

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, ‘Air pollution’, Queensland Government, Brisbane.

Reducing air pollution: personal action (continued)



Personal action	How this action reduces air pollution
At home	
Make compost from garden clippings and food scraps instead of burning them.	Burning rubbish is illegal in most areas in Queensland. It produces soot, other particles, and potentially harmful chemicals. Particles may also be harmful to humans when breathed in. By composting garden clippings and scraps, pollution is reduced and natural nutrients recycled for your garden.
Save electricity, e.g. by turning down the thermostat on an electric hot-water system, insulating an electric hot-water system, or installing a solar hot-water system. Most of the electricity consumed by an average home is used to provide hot water, and room heating or cooling.	In Queensland, electricity is mostly generated by burning fossil fuels, which releases acidic pollutants, such as nitrogen oxides and sulfur dioxide, into the air. Reducing electricity consumption reduces the emission of these pollutants by power stations.
Ban smoking inside the house.	Smoke and other pollutants from cigarettes can build up inside the house, affecting the health of occupants. This pollution is prevented if smoking is not allowed in the house.
Minimise the use of glues, paints or spray cans containing solvents. When you do use such materials, make sure you do so in a well-ventilated area, preferably outside the house.	Solvents in glues, paints etc. can directly damage your health and contribute to photochemical smog. Minimising the use of these solvents reduces pollution.
Make sure your home is well ventilated. In particular, install a ventilation system in your kitchen, or open a window when you are cooking to avoid the build-up of smoke, gases and other emissions.	The air in a well-ventilated home should all be replaced by fresh air every hour. This reduces pollution problems.
Plant trees in your garden and neighbourhood.	Trees convert carbon dioxide into oxygen. They also provide shade, shelter, homes for animals, and food for us and for other animals.

Source: Gratefully adapted with permission from Environmental Protection Agency 1998, *Airwatch Program*, 'Air pollution', Queensland Government, Brisbane.

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This sourcebook module should be read in conjunction with the following Queensland School Curriculum Council materials:

Years 1 to 10 Health and Physical Education Syllabus

Years 1 to 10 Health and Physical Education Sourcebook: Guidelines

Health and Physical Education Initial In-service Materials

ISBN 0 7345 2055 7

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