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We're in it together
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Auckland
Regional Council
TE RAUHITANGA TAIAO



“Despite its importance, clean air is often taken for granted but air pollution has become a major problem in many countries and is a growing problem in Auckland. Unpleasant smells, hazy days, damage to peoples health and damage to plants, buildings and property can all be caused by air pollutants.”

“Air quality is important to everybody. We can choose not to swim in polluted water, to eat organic food, and to purify our drinking water, but we can't choose not to breathe.”

**(State of the Auckland Region Report,
Auckland Regional Council 1999)**

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**Teacher
information**

Air Quality and Environmental Education

Through the exploration and development of the air quality theme and underlying issues within the Auckland region, it is hoped that students will develop:

- **awareness and sensitivity** to Auckland's air quality and related issues
- **knowledge and understanding** of air quality and the impact of people on it
- **attitudes and values** that reflect feelings of concern for our air quality
- **skills** involved in identifying, investigating and problem solving associated with the issues related to air quality and air pollution
- a sense of responsibility through **participation and action** as individuals (and as members of a group) in addressing the issues of air quality and air pollution.

(Ref. Guidelines for Environmental Education in New Zealand Schools p. 9).

Key concepts

- What is air?
- Causes of air pollution
- Sources of air pollution in our neighbourhood
- Air pollution and motor vehicles
- Ways of reducing air pollution caused by motor vehicles
- Domestic fires and air pollution
- Backyard burning and air pollution
- Personal and community commitment and action to improving air quality

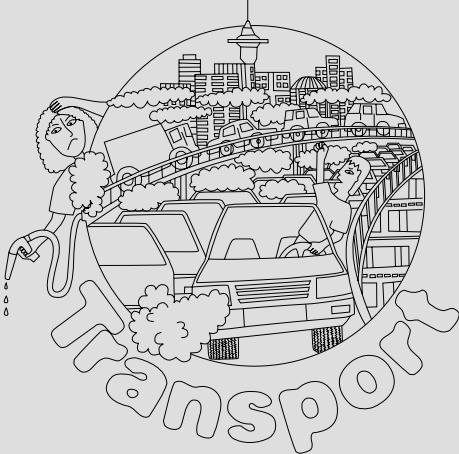
A change in behaviour - for better or worse?

Students are asked in this unit to complete a 'Travel Log' which requires them to keep track of travel habits over a period of a week.

The overall objective of this is to challenge students to reduce their travel by motor vehicle and to encourage family members to do the same. It may be of great value to both teacher and student to redo the survey at the completion of the unit to ascertain if there has been any change in travel behaviour.

(It will be of great value to the environment if a change for the best has occurred!)

Links to other City Issues



Curriculum Area: Science

Making Sense of the Material World

Students will:

- Research the use and purpose of technology in the disposal, or recycling, of some common materials (level 3)
- Investigate the positive and negative effects of substances on people and on the environment (level 4)

Making Sense of Planet Earth and Beyond

Students will:

- Justify their personal involvement in a school or class initiated local environmental project (level 3)
- Investigate a local environmental issue and explain the reasons for the community's involvement (level 4)

Focusing and Planning

Students will develop skills and attitudes as they:

Use their science ideas and personal observation and those of others to make testable predictions or to identify possible solutions for trialling

Information Gathering

Record observations and measurements

Processing and Interpreting

Identify trends and relationships in recorded observations and measurements by making links with organised data

Reporting

Present what they did and report what they found out in their investigation in ways and forms appropriate to their peer group.

Essential Skills

(Highlight as appropriate)

Numeracy	Social / Co-operative
Self-management	Information
Work and Study	Physical
Communication	Problem Solving

Curriculum Links

English
 Maths
 Health and Physical Education
 Social Studies

Possible Learning Outcomes

Students will:

- Identify the issues and problems associated with air quality
- Investigate the possible causes of air pollution
- Demonstrate awareness of different points of view
- Brainstorm solutions to the problem of air pollution
- Use criteria to evaluate solutions
- Make a choice about possible action and justify this choice

Assessment

Teachers may derive specific learning outcomes that are appropriate to the learning needs of their students. These learning outcomes will provide the criteria against which student's achievement can be assessed. Some suggestions for assessment can be found in the Teacher Resource.

Background information

Air

- Air is vital to our survival. All living things need air. We need oxygen for our bodies to change food into energy. Carbon dioxide is essential for plants to make their food.
- Air is made up of gases and tiny particles of liquids and solids -78% nitrogen, 21% oxygen, and 1% mixture of argon, neon, carbon dioxide, water vapour, helium, krypton, hydrogen, xenon, and ozone.
- Sound, light and odours travel through air.
- Ambient air is the term used to describe the air that surrounds us. Ambient air quality depends on the amount of pollutants created by human and natural activities as well as the wind and the weather, and chemical reactions between various pollutants.

Air pollution

- Air pollution occurs when pollutants are released into the air, in amounts that could be harmful to humans and animals, or could damage plants.
- Natural pollutants include dust, gases, smoke and ash caused by bushfires and volcanoes, ocean spray, pollen from flowers, mist, insect droppings and mould growth.
- People cause pollution by burning fossil fuels (coal, natural gas, oil, and petrol) used in transport, electricity generation and industry.
- Some pollutants can be seen (e.g. smoke, smog, ash, soot, dust) but others are invisible (e.g. gases and odours).
- Air quality depends on the amount of pollution produced, and the rate at which the pollution disperses. Poor air quality occurs when the winds are very light, and the pollution isn't blown away. The worst pollution occurs on calm days, and during cold winter days when the pollution is trapped close to the ground (temperature inversions). High pollution levels can also be found in an area with a large concentration of high rise buildings, e.g. Central Business District. Such places trap car exhaust emissions.

Domestic pollution in the Auckland region

- Domestic fires in winter are the main contributors to fine particulate in the air.
- Pollutants from chimneys are:
 - fine particles
 - carbon dioxide
 - hydrocarbons
 - formaldehyde
 - volatile organic compounds
 - polycyclic aromatic hydrocarbons
- Compounds from domestic fires adhere to fine particles that are inhaled deep into our lungs. Some are thought to pose a cancer risk with prolonged exposure.
- Bonfires and incinerators are the other major source of domestic air pollution.
- From rubbish fires comes:
 - fine particles
 - carbon monoxide
 - hydrocarbons
- Rubbish fires are also a nuisance to neighbours. In the Auckland region local councils receives more than 2,000 complaints about open burning every year.

Pollution and motor vehicles

- Vehicle exhaust fumes (vehicle emissions) are one of the greatest sources of air pollution in Auckland (86%).
- Vehicle exhaust fumes adds many millions of dollars a year to health cost in Auckland.
- Vehicles emit (discharge) particles and poisonous gases, most of which cannot be seen. Each vehicle discharges approximately 2 kilograms of pollution per day.

Major Air Pollutants

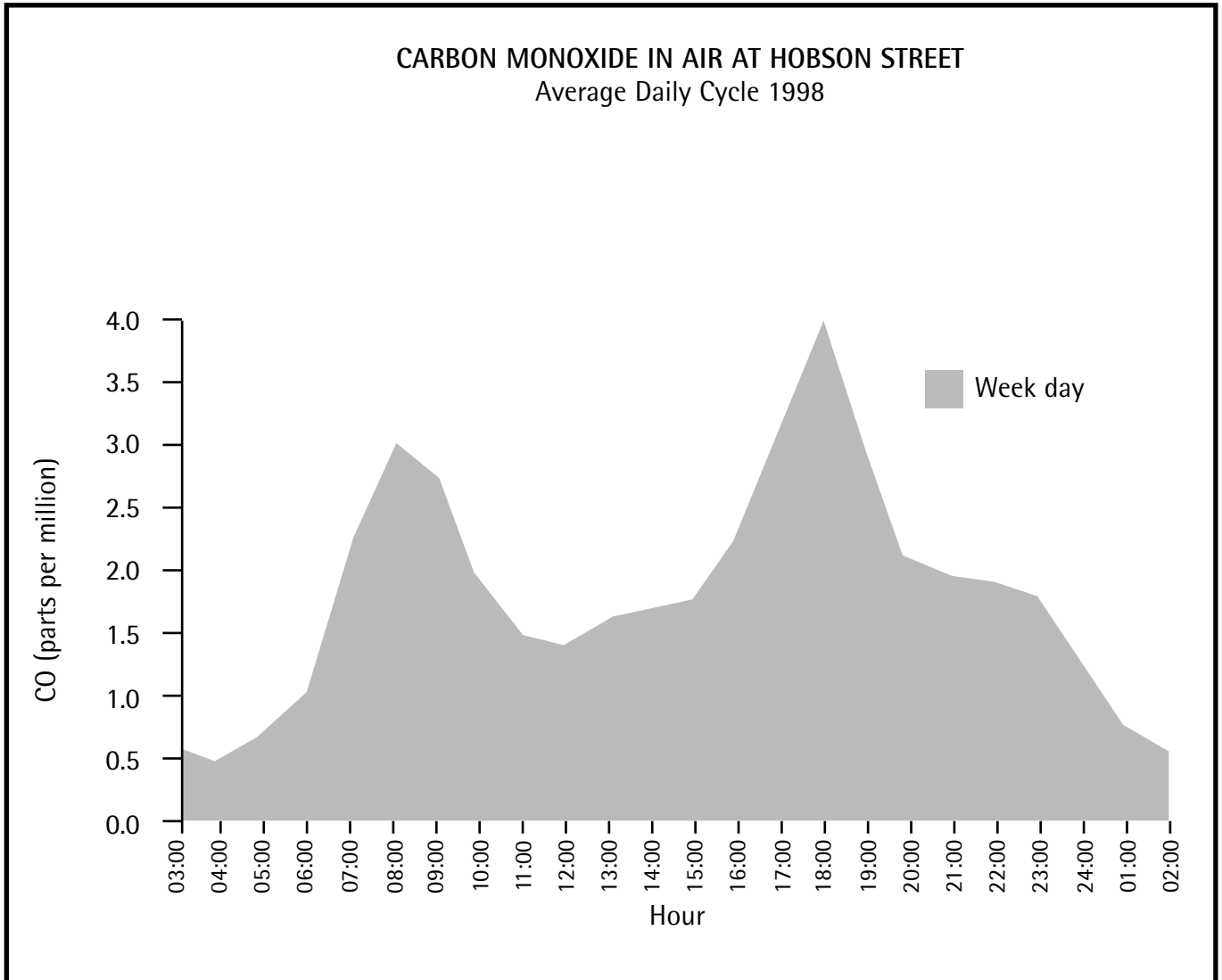
Pollutant	Source	What effect does it have?
<p>Carbon Monoxide A colourless, odourless, tasteless and relatively inert gas which slowly converts to carbon dioxide over a period of about a month.</p>	<ul style="list-style-type: none"> ● Vehicles burning petrol ● Domestic fires 	<ul style="list-style-type: none"> ● Interferes with the ability of the blood to absorb and circulate oxygen. ● Can affect people with heart conditions such as angina and can impair co-ordination and attention. ● Causes headaches and vomiting. ● Large amounts can kill.
<p>Nitrogen Dioxides A reddish, brown, pungent, acidic gas.</p>	<ul style="list-style-type: none"> ● Vehicles burning diesel or petrol ● Domestic fires ● Power stations burning fossil fuels ● Major industry 	<ul style="list-style-type: none"> ● Can lead to throat and lung infections, including bronchitis and lung damage and increased risk of infections from viruses. ● Low level exposure to nitrogen dioxides can affect growth and cause damage to some plants. ● Can significantly affect visibility as it contributes to the formation of hazes and smog.
<p>Ozone A colourless gas with a distinctive pungent odour. It forms under certain conditions when nitrogen oxides and volatile organic compounds react in the presence of sunlight.</p>	<ul style="list-style-type: none"> ● Vehicle exhaust fumes ● Formed from other air pollutants in the presence of sunlight 	<ul style="list-style-type: none"> ● Can seriously damage plants and animals. ● Causes runny eyes, nose and throat irritation and breathing difficulties, especially in asthmatics. ● It also affects the functioning of the heart.
<p>Sulphur Dioxide A colourless, pungent, acidic gas which readily reacts in the air to form sulphuric acid and other compounds. It is usually oxidised in the air within a few days.</p>	<ul style="list-style-type: none"> ● Vehicles burning diesel ● Coal burning ● Power stations and industries ● Oil refineries 	<ul style="list-style-type: none"> ● Irritates the lungs, causing coughing, wheezing or breathlessness. ● Asthmatics may suffer from reduced flow of air when levels of sulphur dioxide exceed the guideline values. ● Is toxic to some plants and is corrosive to some building surfaces and metals in moist conditions. ● Is a major contributor to acid rain in the Northern hemisphere.
<p>Fine particulate (Very small particles of dust). They are not visible to the human eye but do create a visible haze in the air.</p>	<ul style="list-style-type: none"> ● Diesel engines ● Industry ● Windblown dust ● Domestic fires ● Backyard burning ● Power plants 	<ul style="list-style-type: none"> ● Can be inhaled into the throat and lungs. ● Can lead to asthma and bronchitis and cause lung disease. ● Can carry carcinogenic materials into the lungs. ● Affect visibility by creating a haze over large areas, and can contribute to soiling and corrosion of buildings.

Monitoring air pollution

- The Auckland Regional Council monitors air quality around the region, including residential and industrial sites.
- Key pollutants are monitored because they are indicators of the main types of air pollution found in urban areas. For example carbon monoxide and nitrogen oxides are produced mainly by motor vehicles, so if there are high concentrations of these pollutants in the air, there will also be other motor vehicle pollutants.
- Key pollutants are monitored at representative sites in the region:
 - Peak traffic and central business district sites are 2-3 metres from roadsides, where pedestrians and people working close to busy roads would be exposed.
 - Residential monitoring sites are in suburban areas at least 10 metres from any road representing areas where people live.
 - Remote sites are away from the city and any significant roads in areas that are not heavily populated but are still affected by pollution from central Auckland.
- The pollution levels that are measured at these sites are compared to the Environmental Performance Indicators developed by the Ministry for the Environment.

Carbon Monoxide (CO) in the air

This graph shows peak carbon monoxide levels during peak traffic times.



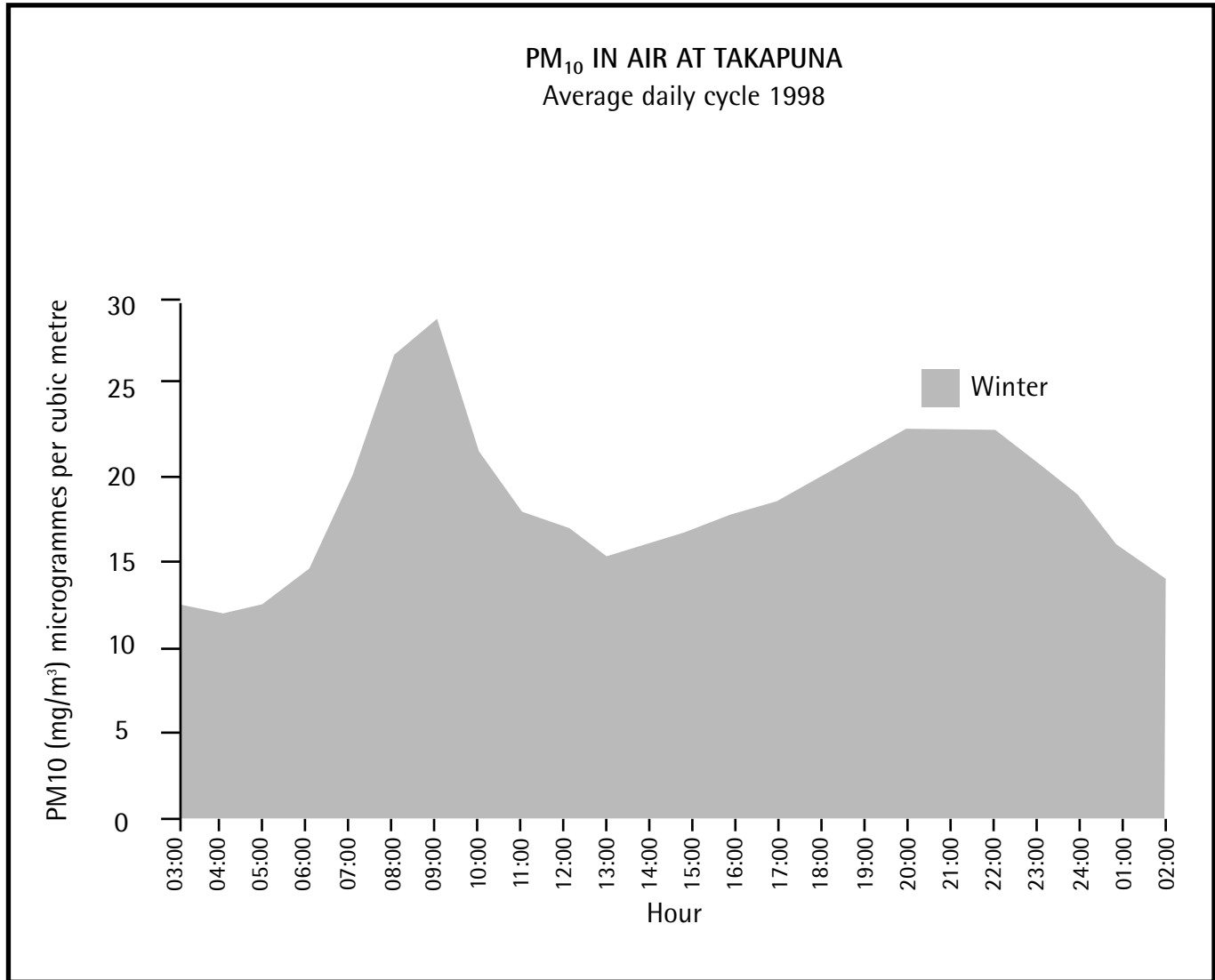
We all know that traffic levels peak twice a day, "rush hour" in the morning, as everyone drives to work and in the evening as everyone drives home again.

Morning rush hour traffic is between 07:00 - 09:00, and evening rush hour traffic is between 17:00 - 19:00.

Find the rush hour periods along the bottom axis of the graph and see what happens to the carbon monoxide levels. They peak too, twice a day just like the traffic. This means that when there are a lot of cars on the road, there is a lot of carbon monoxide in the air. Motor vehicles are a major source of carbon monoxide pollution.

Fine Particulate (PM₁₀) in the air

This graph shows peak fine particulate levels during peak traffic and domestic fire periods.



Again there is a high peak in fine particulate levels during the 7:00 - 9:00 am morning rush hour, and again in the evening.

Notice, though, that the fine particulate evening peak is broader than that of carbon monoxide. The level of this pollutant remains high all evening, lasting well through the rush hour period and into the night. This is a winter trend which indicates that smoke from domestic fires is also a source of particulate pollution.

What can you do to help reduce air pollution in Auckland?

- Drive your car less. Instead - walk, bike, bus or car pool, especially during congested periods, and combine many chores with each car trip.
- Tune engines regularly to reduce particulate emissions and save costs (especially diesel engines).
- Make sure your new car has a catalytic converter and don't remove it.
- Check the chimney to make sure your fire doesn't create too much smoke (if it does you are wasting fuel as well as polluting the air).
- Don't burn anything other than dry, seasoned wood, and use kindling and paper to start your fire.
- Don't bank the fire up and allow it to smoulder all night - this releases higher levels of pollutants.
- Make sure your chimney is cleaned every year, is well insulated, is high enough to let smoke and gases disperse and does not have a 'hat' which deflects the smoke downwards.
- Don't burn rubbish at home (inside or outside).
- Call the ARC for advice on where to recycle or safely dispose of non-recyclable wastes:
0800 REDUCE or 0800 733 823
- If you decide to burn rubbish then call your local council first as it may be prohibited, or if not you will probably need a fire permit.
- Don't burn:
 - plastics
 - rubber
 - paint
 - poisons
 - painted wood
 - treated timber
 - dust
 - food scraps
 - wet material
 - fabrics
 - green grass
 - foliage
 - tins
 - glass

These materials may produce large quantities of toxic smoke.
- If you do have an incinerator make sure that it is at least 12m from any building, there is air circulating through the fire, and that the wind isn't blowing towards your neighbours washing or through their windows.

Not a pretty picture

There are four photographs included in the air quality section of City Issues. They depict the following:

Harmful emissions from a smoky vehicle



Smoke from backyard burning



Smoke from a domestic fire



A layer of smog over the Auckland region



The photographs could be displayed and used as an initiating activity as follows:

- Write a caption/statement/headline/title for this photo
- Write a brief description of what you can see
- Write a question about this photo
- What is happening in this photo?
- Photo disclosure. Part of the photograph is hidden and students are asked to record their response: 'From what you can see, what might this whole photo be about?'
- Photo walk - display all photographs and ask students to make notes as they think of the theme that runs through the photographs
- Ask students to identify the problem that the photo shows and to list possible solutions to the problem.

Other activities could include:

- Compile an air pollution vocabulary list.
- Discuss. Where is the cleanest air? (Rural/remote areas).
- The air inside our homes can also be polluted. How?
- Research the air quality issues that are particular to rural areas (spray drift).
- Gather pictures of causes and effects of air pollution from newspapers, magazines and internet - create a montage.
- Investigate how industry contributes to air pollution in the Auckland region.
- Investigate the role weather patterns/season plays in air pollution (Auckland relies on sea breezes to transport and disperse pollution).
- Demonstrate what comes from the exhaust pipe of a car **(There are very real safety issues with this activity but if properly controlled it will prove worthwhile).**

Complete this activity in the early stages of work on motor vehicles and air pollution.

- Place white socks over the exhaust pipe of a number of teachers/parents cars.
- Ask the car owner to run the car for five minutes. Students must stand

well clear, as the fumes are extremely toxic.

- Wait for another five minutes until the socks are cool enough to remove. (It would be a very good idea to wear gloves to do this).
- Turn the socks inside out. Make a display in the classroom.
- Discuss the results and make some predictions about what has happened to the socks.

- *"Lichens are extremely sensitive to air pollution and can sometimes be used as indicators of air quality. Shrubby and leaf-like lichens can only survive in clean air. Lichens are relatively rare in large cities and in areas where there is very heavy air pollution there are no lichens of any type."*

(Ref. "Lichen Looking" - Outdoor Biological Instructional Series, developed by Lawrence Hall.)

Discuss lichens as clean air indicators with the class. Make sure students can identify lichens and then go on a lichen hunt in the school and neighbourhood.

(Make some predictions about the type and amount of lichen that they might find).

Note. In newly developed areas there are likely to be very few lichens.

- Demonstrate (outside!) what happens when different substances are burnt e.g.

 - plastic bag

 - plastic milk bottle

 - polystyrene

 - decaying leaves

 - wet wood

 - fabric

(Ensure that students don't inhale the smoke.)

- Students make predictions about what might happen as each different substance is burnt. (Relate this to backyard burning and domestic fires). Record observations.

- Invite an 'expert' from the Auckland Regional Council to talk to the class about air monitoring in Auckland.

- Consider questions such as:

 - Why is the quality of our air monitored?
 - Where is air pollution monitored in the Auckland region?
 - How is air pollution monitored?
 - What is measured by the monitoring instruments ?
 - How does our air pollution compare with other parts of the world?
 - What would happen if we didn't monitor the quality of the air?

Suggestions for monitoring and assessment

Complete a concept map that represents what is known about air and air pollution.

Design a poster with specific criteria e.g. a poster that increases people's awareness of the major causes of air pollution in the Auckland region and ways air pollution can be reduced.

Make a slide show to educate others about.....

Interactive approach

- observing
- working with small groups
- listening to discussions

Conferencing individuals - groups (an example)

- 'Tell me about your.....!'
- 'Explain your.....!'

Checklists

- Use specific skills and objectives as criteria

Peer support

- Students give constructive/positive feedback to peers (design specific criteria)

Self Evaluation

Students complete an evaluation sheet that can include the following:

- In this study I enjoyed learning about.....
- The most interesting fact I learned was.....

- Four new words and their meaning I have learned are.....
- The most interesting sentence I read / learned about the topic was.....
- One thing I would like to find out more about is.....
- This picture / illustration shows.....

Complete activities from this resource:

Believe it or not (experiments) - page 30.

'I is for Issues - page 34.

Survey forms in all activities.

Environmental Action Planner

What's the issue?	
What's our goal?	
What skills will we need?	Who could influence the decision? Who makes the final decision?
ACTION What are we going to do?	
Evaluation of action	Evaluation of plan
How will we find out what people think and feel about the issue?	How can we make people more aware of this issue?
What information do we need and where will we find it?	

Resources

Included in City Issues - Air Quality pack

No.	Type	Resource
1	Poster	Auckland's Air Pollution
2	Photographs	Set of 4 - Air Pollution problems
3	Air Facts 1	Domestic Fires - Inside the House
4	Air Facts 2	Rubbish Burning - Outside the House
5	Flyer	Tune Your Vehicle
6	Flyer	Ten tips to reduce vehicle pollution and save you money
7	Metro article	SMOG - Auckland's dirty secret

Resources are available from:

Auckland Regional Council 09 366 2000

(for callers outside the toll free area please phone 0800 80 60 40)

You can also download the resources from our website: www.arc.govt.nz

School journals

Sky	by P. Friend	1999 1:1
Tape available	Linda asks everybody in her family "Why is the sky blue?" See which answer you think is best.	
When the air moves	by E. Petro	1999 2:2



**Student
activities**

A is for air, action and activities

(Gathering before - views)

A riddle to get you started.



What am I?

You can find me in soil but also in water

You might think something is empty
but it is probably full of me

You can't see me but you can feel me
and see what I do

If I'm not clean it means something
has been put into me

I surround Planet Earth with a layer
of what I am

Living things can't survive without me

People can't live without me

I am _____

(Answer Air)

So what is this thing called air?

Time for a bit of group work.

DISCUSS

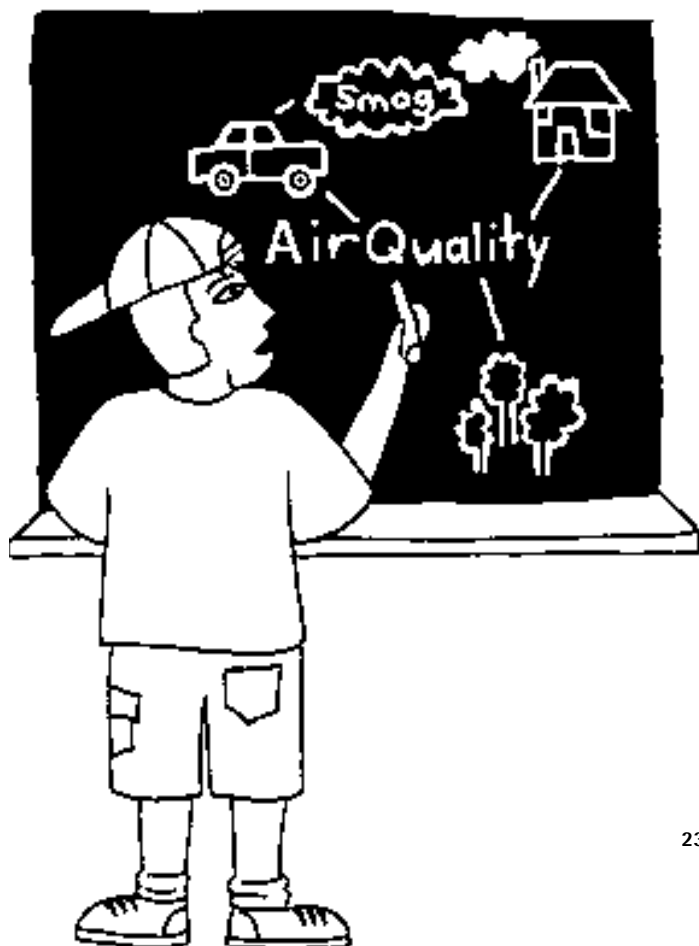
- What is air?
- What is air made of?
- Who needs air?
- What travels through air?

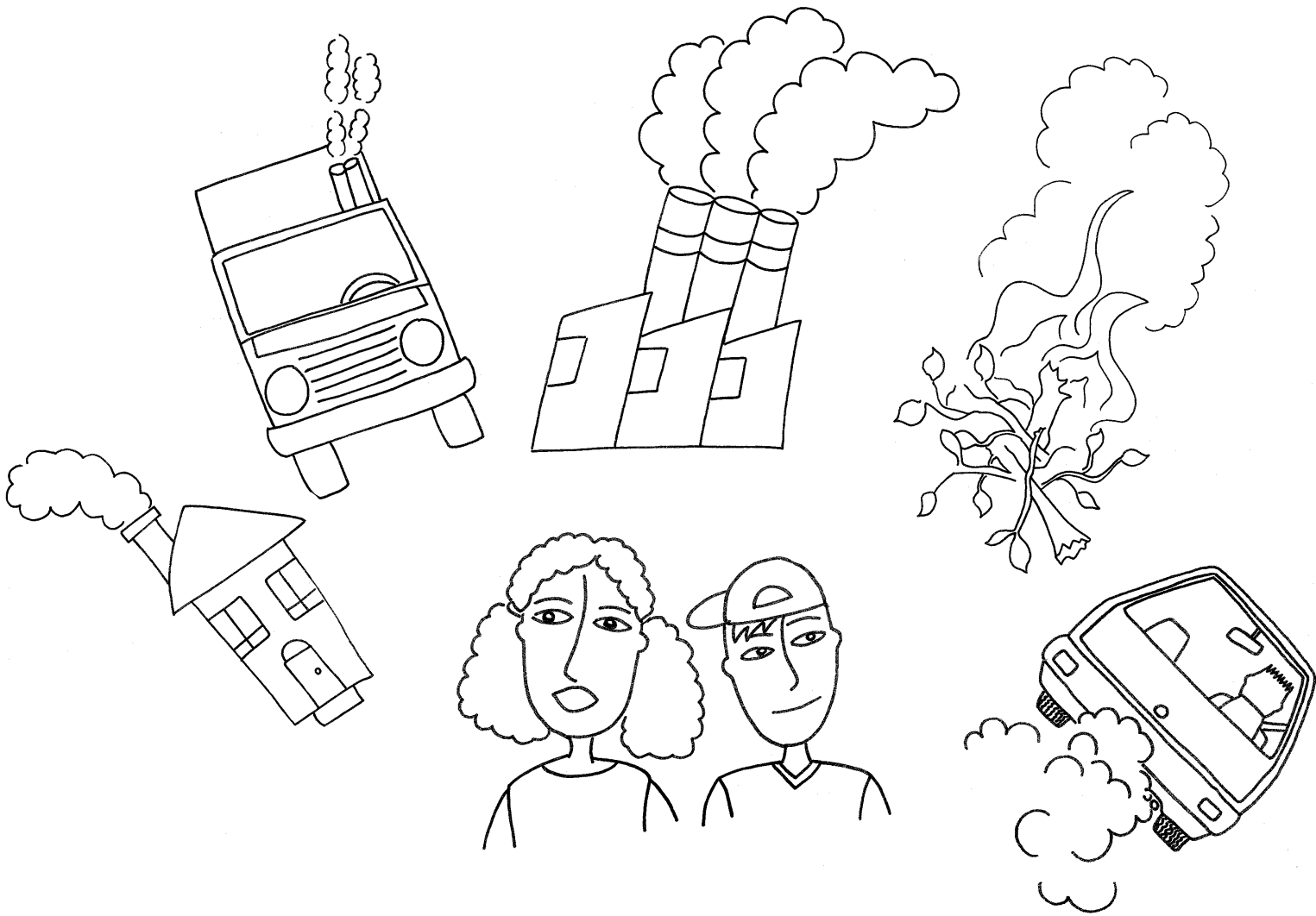
Put your ideas together in a mind map about air.

These are your before-views (what you think now). You might end up changing these ideas during your work on the air quality theme.

YOUR MIND MAP COULD INCLUDE

- a drawing of what your group thinks air is made from
- pictures / symbols / short sentences about things that **live** and **travel** in the air
- key words





Great minds think alike... sometimes!

Bring the ideas together to make a class model of
“What is this thing called air?”

REMEMBER



These are your before-views and they may change as you work through the Air Quality theme.

P is for pollution

Fact: Our air is a shared resource, recycled over and over since the beginning of time.

Fact: The quality and cleanliness of our air we breathe depends on what we do to the environment.

Fact: Air pollution occurs when pollutants are released into the air.

Fact: Some pollutants can be seen (e.g. smoke, smog, ash, dust) but many pollutants are invisible (e.g. gases and odours).

Fact: Auckland has a growing air pollution problem. The population is expected to double in the next 40 years and we may end up living in soup if we don't do something about the causes of air pollution now.

Fact: You have some more work to do.

YOUR TASKS



- Identify types of air pollution that can be found in the Auckland region. Think about, and look for, the things that are changing the quality of the air we breathe.
- Complete the Air Pollution grid.
- Work with a small group. You will need to agree on how to measure the pollution you

→ **see** → **know about** → **have experienced**

- When you have finished the tasks share what you have done with the rest of the class.

VISIBLE**SOUND****SMELL**

By a section
of busy road
or motorway

a Peak
period traffic
7 - 9am

b 4 - 6pm

c Off-Peak
period traffic
10 - 12pm

d 2 - 3pm

VISIBLE**SOUND****SMELL**

Your
neighbour-
hood on a
cold winter
night

Around the
school at
lunchtime

An area
of town
with lots of
factories

a On a
weekday
afternoon

b On a
Sunday
afternoon

	VISIBLE	SOUND	SMELL
A crowded beach on a Sunday afternoon			
A room where people are smoking			

When you finish you should have some ideas that will help you to complete this statement:

I / We think that air pollution in Auckland comes from:

Believe it or not!

(Part One)

Particles, particles everywhereor not?

Is our air really polluted ?

Find out how clean the air around us is by carrying out a few experiments.

Read through the experiments

Collect the equipment you will need

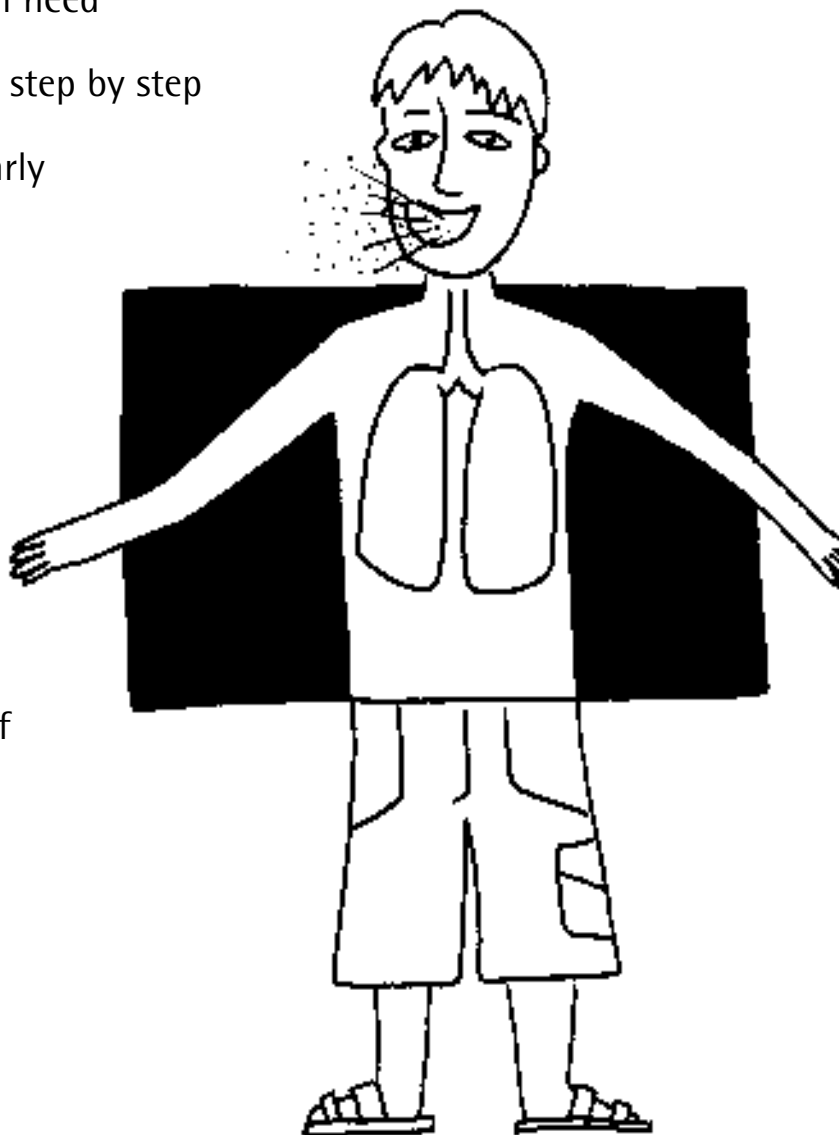
Work through the experiments step by step

Present your information clearly

How well can you count?

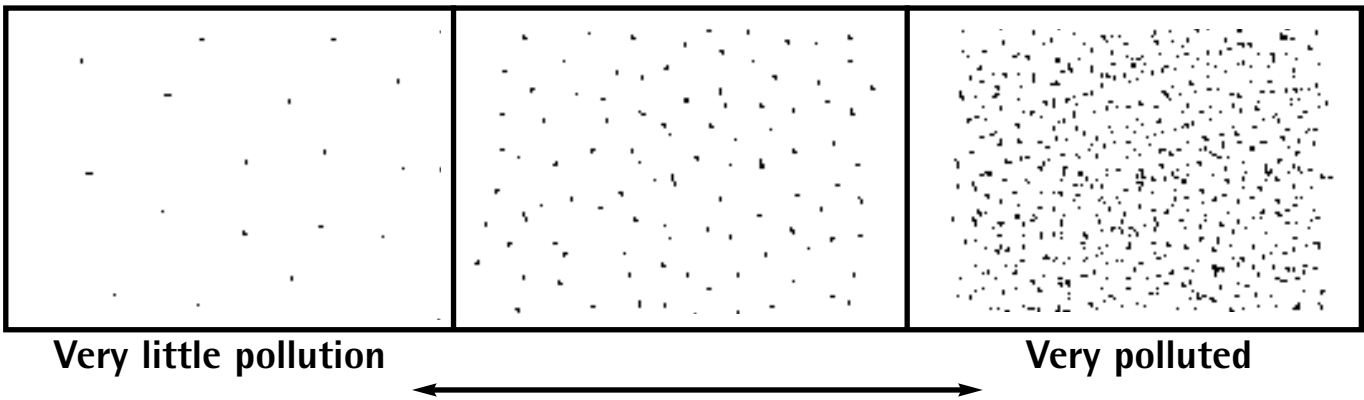
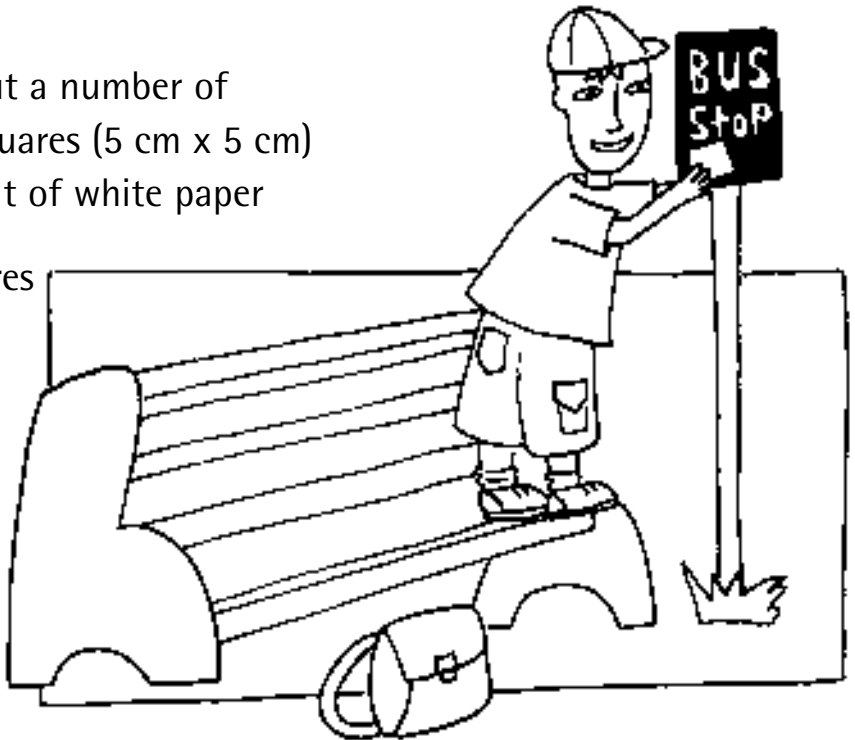
This experiment is to do with finding out about visible air pollution that comes in the form of particles.

These particles are made up of tiny pieces of solid matter and droplets of liquid. Particles are carried through the air and can be harmful to both plants and animals (including us).



WHAT YOU HAVE TO DO ➔

- Cut a number of squares (5 cm x 5 cm) out of white paper
- Smear Vaseline over the squares
- Put the squares in different places around the school e.g. under the trees, near the playground, near the street, near the carpark, somewhere in the classroom
- Count the particles (small pieces of matter) that collect at the end of a day
- Devise a Pollution Particle Indicator to help you to measure what you have collected. Your P.P.I. might look something like this:



Present your data on a graph. Summarise your data by making statements and inferences about the **amount** and **sources** of air pollution (where it has come from).



Keep your scientific thinking hat on and continue work on Part 2 of this activity.

Believe it or not!

(Part Two)

Check out the dust collectors

Check out the amount of dust and dirt in your environment by looking at what has collected on the trees in your environment.

- Select a given number of trees in different locations around the school
- Wipe a leaf from each tree with a slightly damp ball of cotton wool
- Classify each leaf on a scale of 1-5 of dirtiness (*this is a scale that you devise*)
- Present your findings on a chart showing:

Where the leaf was collected

Cotton wool test - scale of dirtiness

Statements / inferences about findings

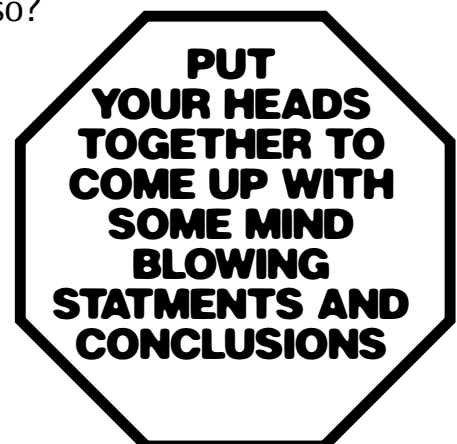
Continue your air pollution data collections by carrying out the same tests:

- outside your house
- near the street
- in your local park
- on your windows (*you can clean them when you've finished experimenting!*)

Compare these results with those done around the school.

Are they the same or different?

If the results are noticeably different why is this so?

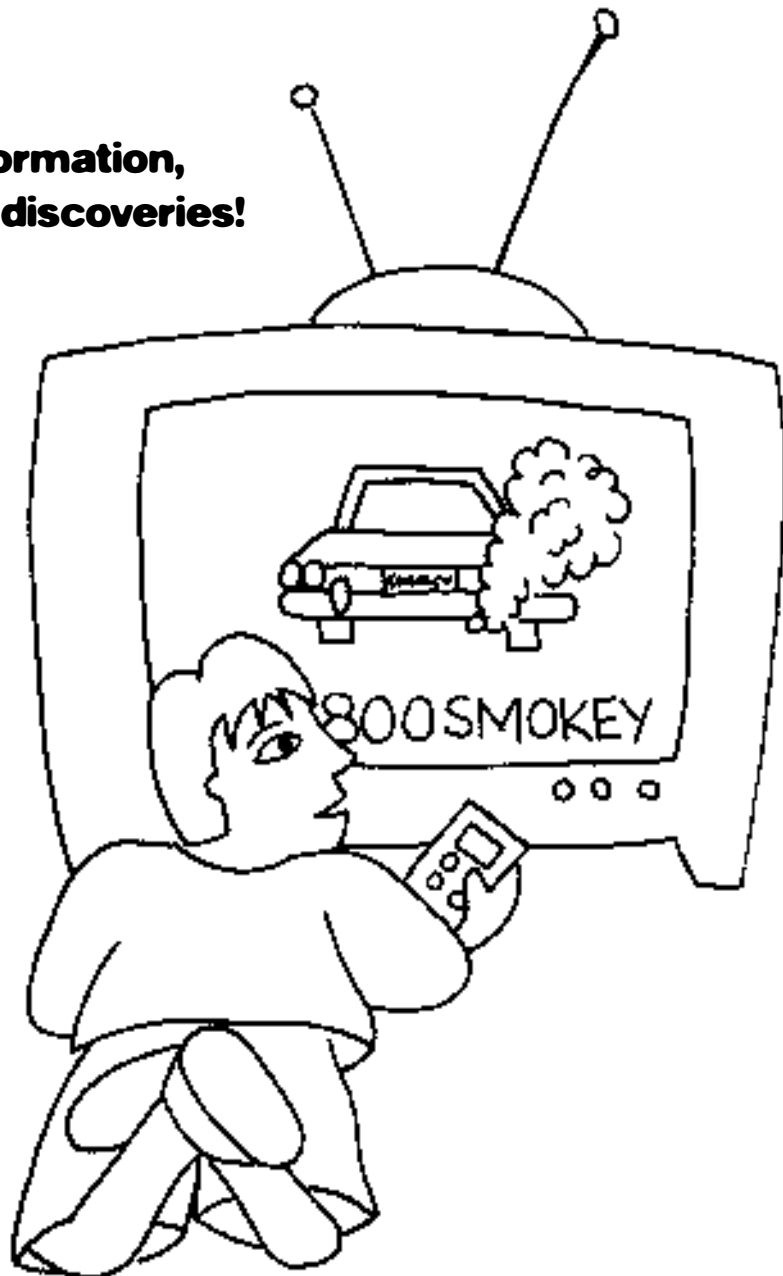


Your work is not finished. Just when you thought it was time to sit back and get a lung full of air (polluted or not) there's more to do.

You might now be convinced that the air in some parts of Auckland is polluted by particles but what about the pollution we can't see?

- What about the gases and odours?
- Where do they come from?
- What do they do to the air?
- Do they matter?
- Should we care?

**Stay tuned for more information,
more work and greater discoveries!**



I is for issues

(Part One)

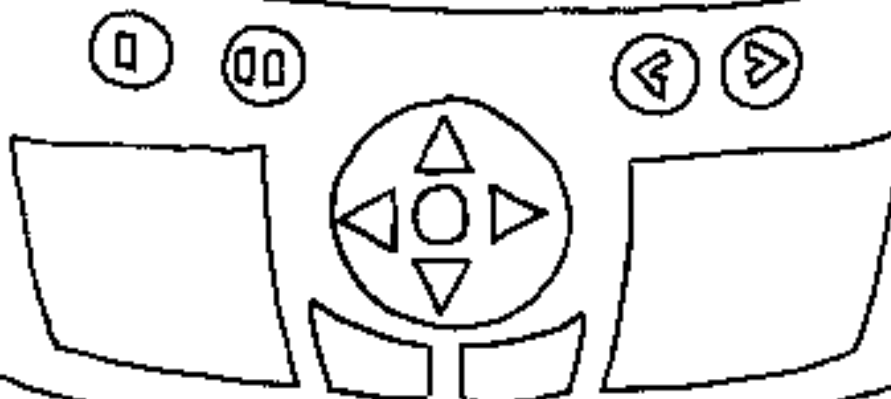
Auckland 2100

Dear Diary

I am so totally fed-up. This is the third day in a row I haven't been able to go to school. Doing all my schoolwork from the Internet just gets so boring and I really want to hang out with Zac and Alex again.

Right now you can't see more than 100 metres down the road and even being outside for two minutes makes your eyes sting and you feel like your lungs are burning if you even dare to walk to the edge of the section without a smog mask.

I HATE wearing the smog masks. They just so totally annoy me but Mum says heaps of people are being treated for major asthma attacks and stuff like that because they've been out too long in the polluted air without a mask. Josh had to be put on oxygen three times last month. He tries to hide how bad he's feeling but you can tell because he's always making excuses about not coming out to the field with the rest of the guys.



It says on the History-Link that people were wearing smog masks in places like Japan more than one hundred years ago and you couldn't walk the streets in some parts of Los Angeles without getting a serious burning throat. And get this - in some parts of the world, back then, every time you blew your nose it was a major clean out job because your nose would be full of stuff from the air. YUCK! It's so weird that they didn't fix the problems up way back then.

Dad says I have to stop complaining - he says that it's not like he can do anything about the air pollution. Yeah well, maybe, maybe not. I reckon they should have thought about the problem a LONG time ago when he was a kid. He said that even then they used to talk quite a bit about stuff like too many cars on the road, not enough people getting their cars tuned regularly, too many people using wood burners in their homes and burning their rubbish in their back yards. That's all anyone has done - TALK, because look at the mess we're in now.

Sometimes I wish I'd been born 100 years ago - at least we would have been able to have a decent game of soccer without the air pollution alarm going off.



**PLEASE
MOVE ON TO
PART TWO
OF THIS
ACTIVITY**

I is for issues

(Part Two)

Think about the diary entry. How does it make you feel? Could this actually be what life will be like in Auckland 100 years from now?

List in your head or on paper, the major causes of air pollution mentioned in the diary entry. (These are some of the problems that Auckland is facing today).

Just to help you

get your head around the issues a bit more you could complete the following activity:

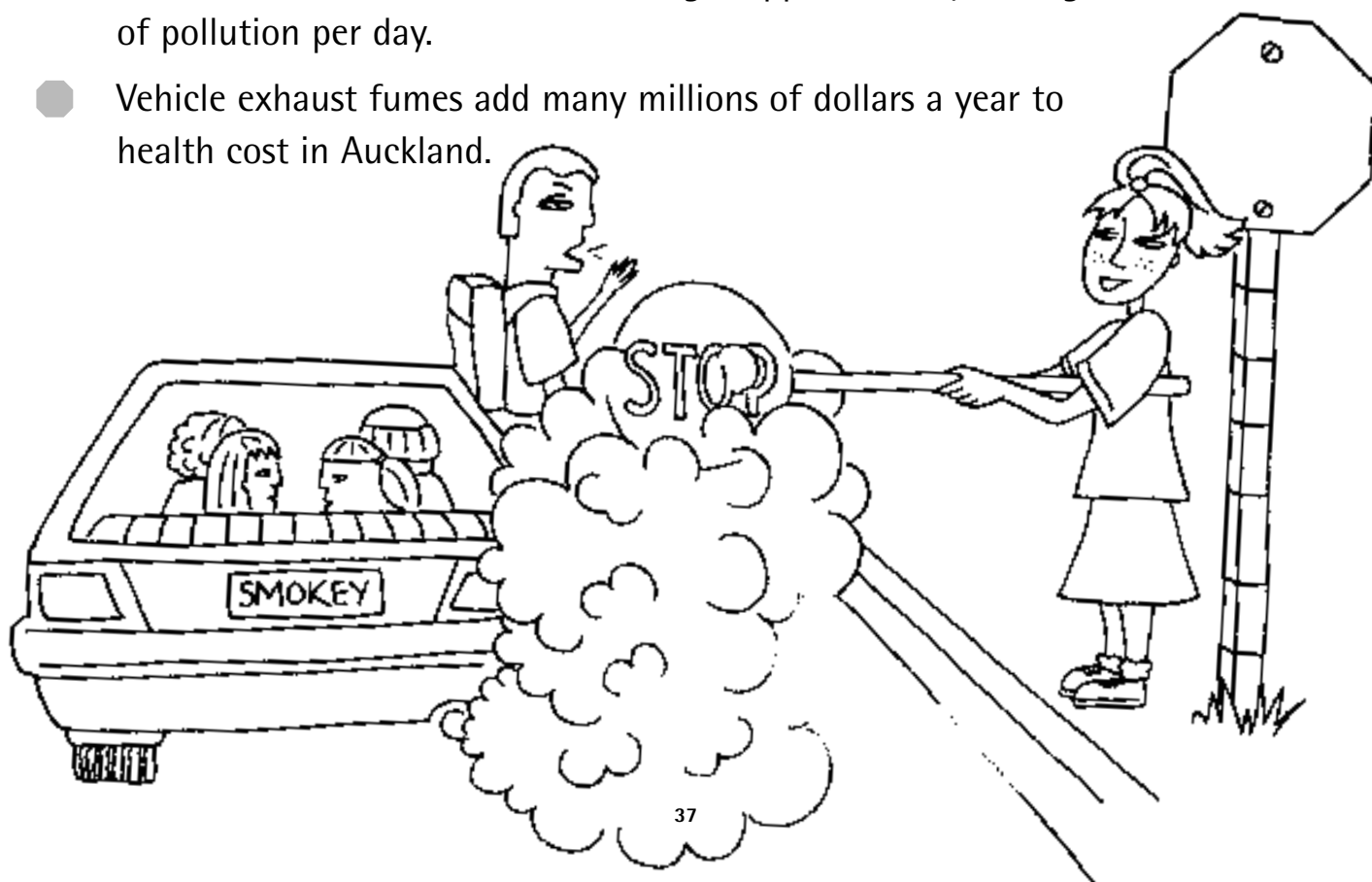
- Use crayons and dye to draw a picture of the Auckland the diary entry describes.
- Show clearly where the air pollution is coming from.
- Write a statement about what you think needs to be done NOW to prevent this scenario from happening.
- Display this beside your picture.



And then there's the problem with vehicles

Key facts to get your head around

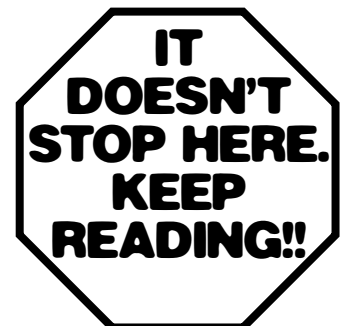
- Vehicle exhaust fumes (vehicle emissions) are one of the greatest sources of air pollution in Auckland (86%).
- There are currently approximately 650,000 vehicles in the Auckland region.
- Each vehicle travels approximately 12,923 km per year or 35 km per day.
- Vehicles emit (discharge) particles and poisonous gases, most of which cannot be seen. Each vehicle discharges approximately 2 kilograms of pollution per day.
- Vehicle exhaust fumes add many millions of dollars a year to health cost in Auckland.



Pollutants from motor vehicles and their health effects

POLLUTANT	HEALTH EFFECTS
Carbon Monoxide	Causes headaches and vomiting. Large amounts can kill.
Nitrogen Oxides	Can lead to throat and lung infections, including bronchitis and lung damage. Increased risk of infections from viruses.
Ozone	Can seriously damage plants and animals. Causes irritation to eyes, nose, throat and lungs.
Small particles	Can be inhaled into the throat and lungs. Can lead to asthma and bronchitis and cause lung disease.

- The population of Auckland is expected to double in the next 40 years. This means more cars (travelling further to work each day) and increased levels of air pollution unless we start doing something now to stop this from happening.



So what happens next?

Time to sharpen your pencil or recharge your laptop. Time for a bit of serious work.

There are several parts to the work on vehicles and air pollution in the Auckland region.

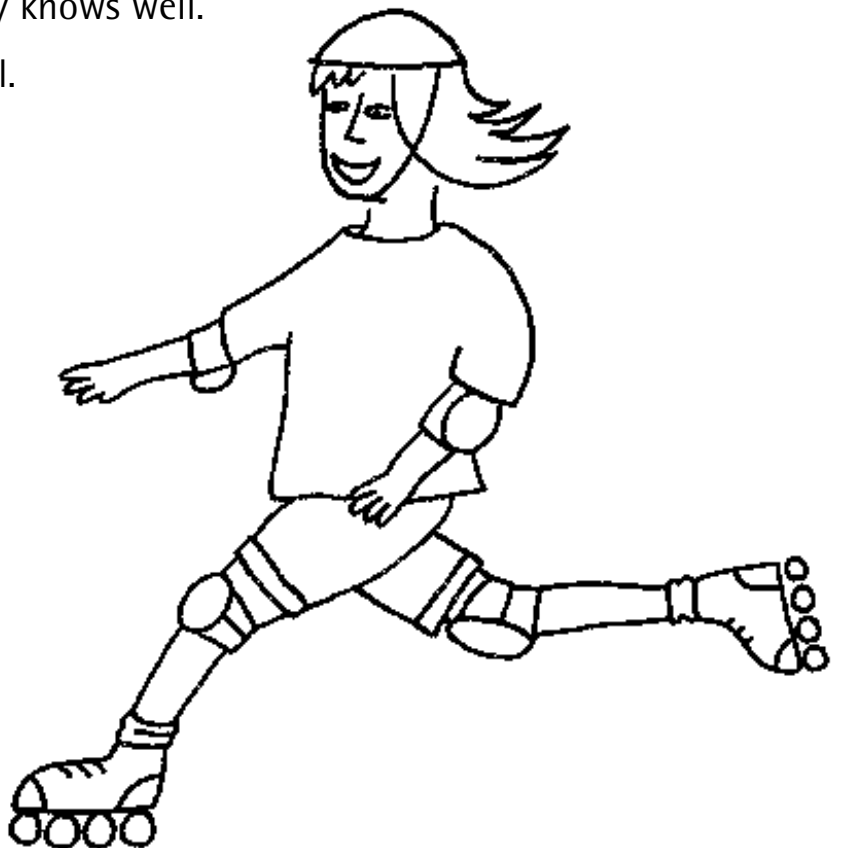
YOU might do all or just some of these activities.

(Your teacher will give you some guidance with this).

MANY of the activities are about investigating vehicle use in your family.

If you don't have a car you could do one of the following:

- a** Work with a friend.
- b** Ask a member of your extended family to help you complete the surveys.
- c** Or ask a neighbour your family knows well.
- d** Or ask a teacher in your school.



(p.s Don't worry if you don't have a car. Remember it's becoming very, very environmentally friendly not to be using one!)

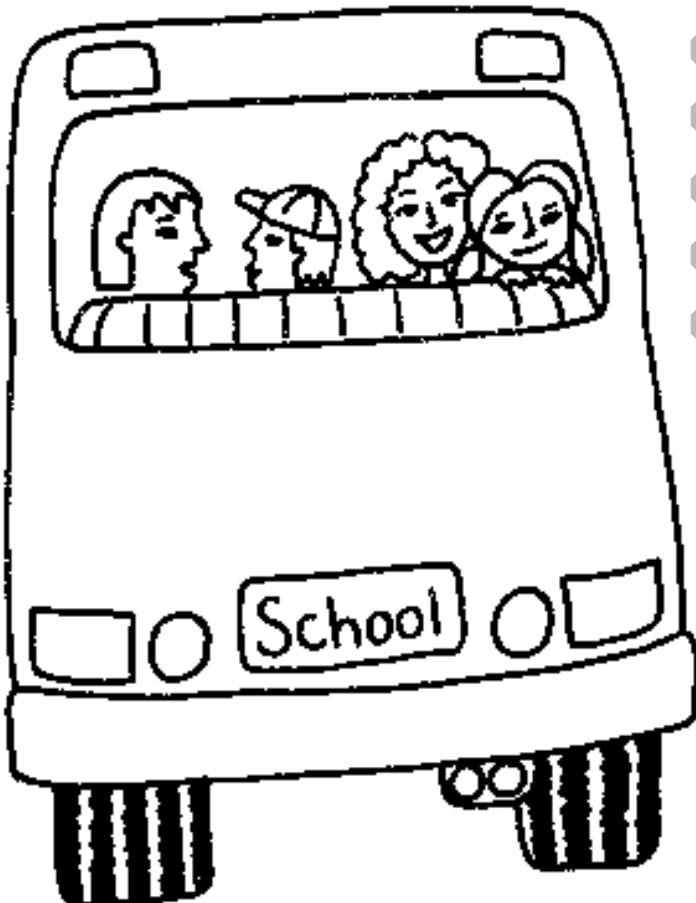
What's the point in doing all these activities?

It's all about helping you to:

- a Understand** how motor vehicles contribute to air pollution in the Auckland region.
- b Become more aware** of what can be done about our growing air pollution problem.
- c Find ways of taking action** to help with the air pollution problem.

And the activities just so happen to be!

- Who's Smoking?
- Tune in. Tune up. Drive out.
- Travel Log
- Diary of a Week in the Life of a Car
- Clean Air Driver
- Weekly Vehicle Health Check
- What's the Plan Stan?

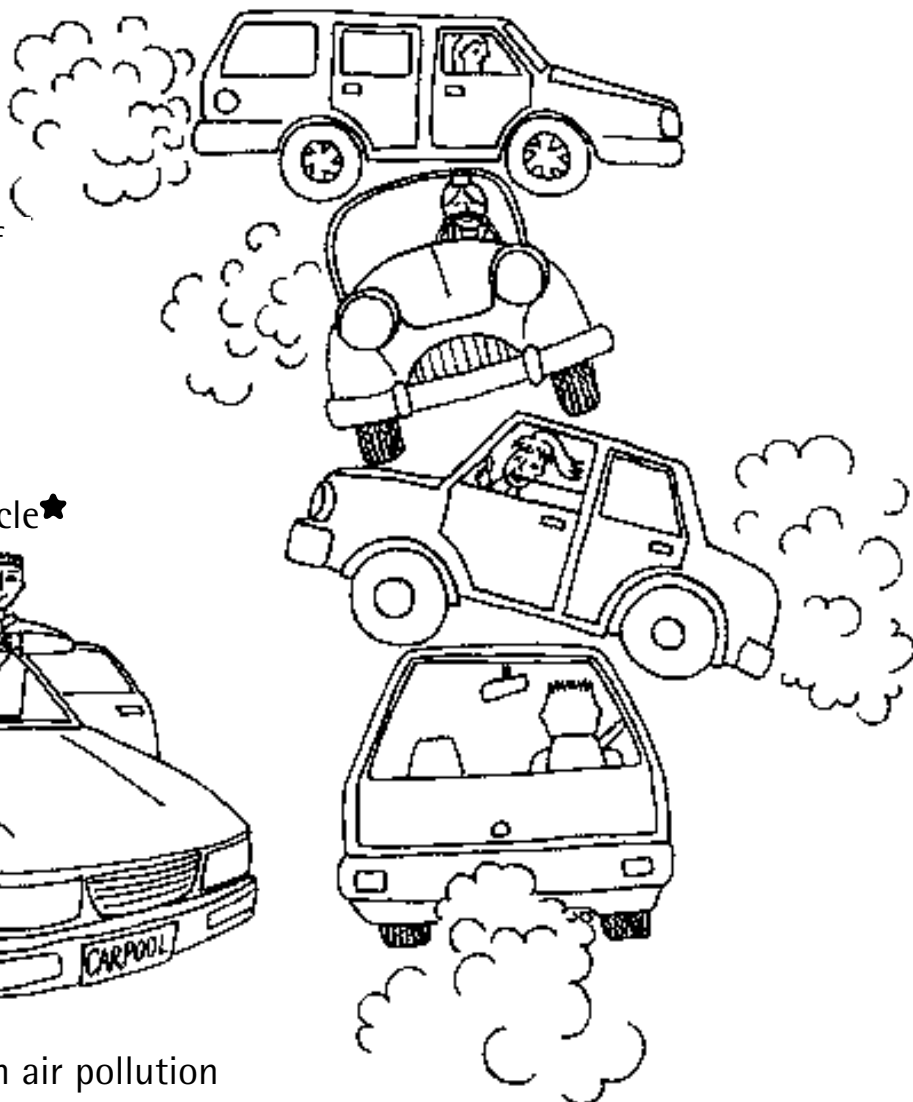
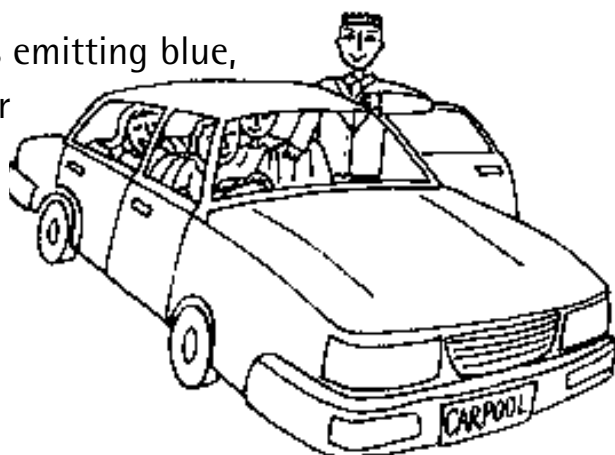


Who's smoking?

Here's where you investigate the number of motor vehicles travelling on nearby roads and how they are contributing to air pollution.

Step one

- You will be working in groups of four to complete this survey.
- Decide who in your group will be counting the number of vehicles with:
 - a one person per vehicle★
 - b two people per vehicle★
 - c three people or more per vehicle★
 - d vehicles emitting blue, white or black smoke



★The number of people a vehicle carries can have an effect on air pollution

e.g. a bus carrying twenty people will use less fuel and produce less air pollution than twenty cars carrying one person each. A car carrying four people will pollute less than four cars carrying one person each.

- Record the starting and finishing times for your group

Counting starts at and will continue for minutes

Step two

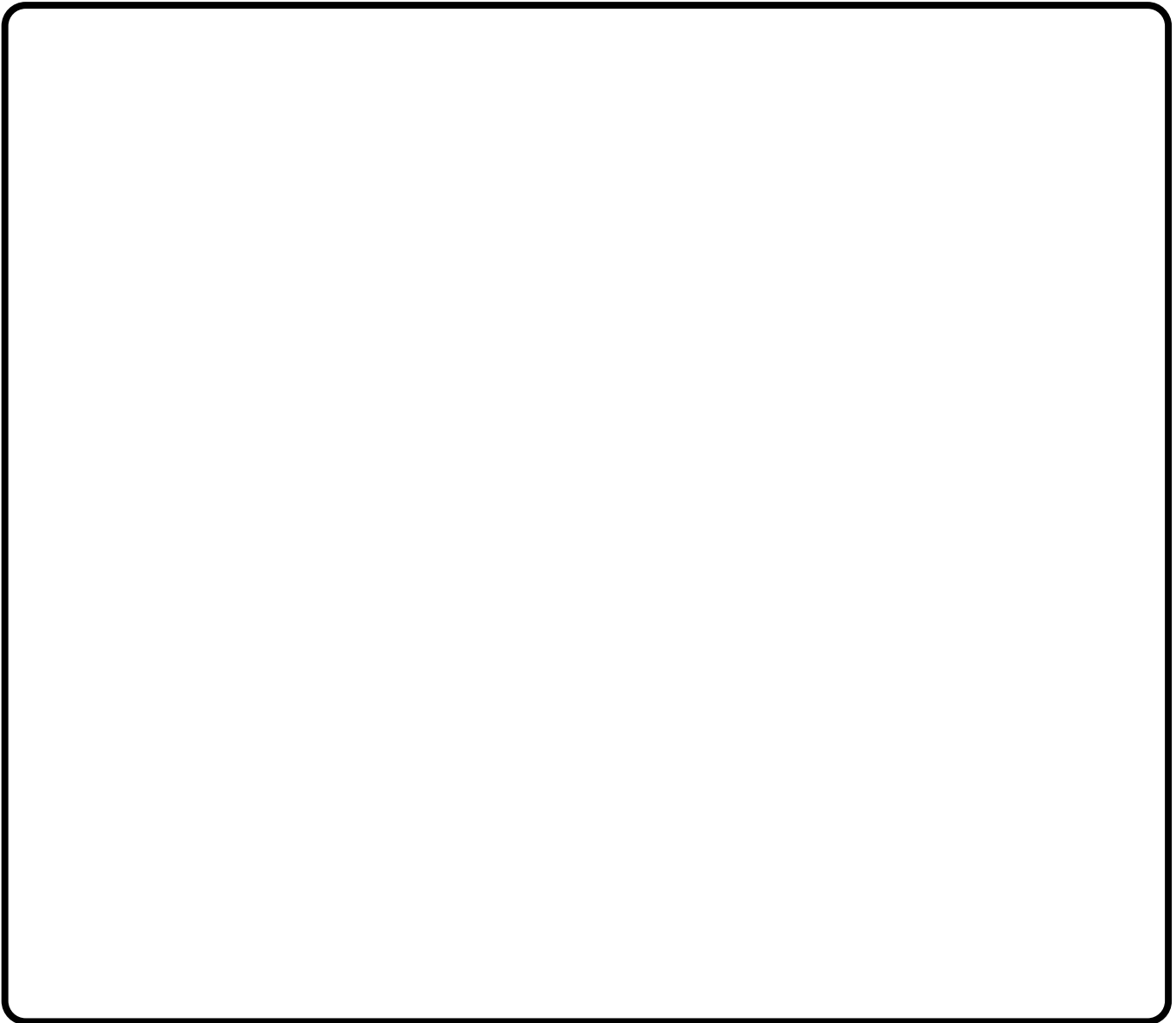
- Choose a road near school.
- Record your information using a tally system in the space below.
- **Note: Vehicles include cars, buses, trucks, vans, motor bikes.**

TYPE OF VEHICLE	TALLY (////)	TOTAL

Step three

The total number of vehicles counted was

Step four Plot your group's results in bar / pie graph form below.



Step five Write a statement summarising the findings of your survey.
Be prepared to discuss this with other groups.

Tune in. Tune up. Drive out.

THE PROBLEM



20% of vehicles provide 80% of pollution

What does this mean?

Many vehicles blow smoke. This smoke is coming from vehicles that are often badly maintained or badly tuned or from diesel vehicles. All are a huge cause of air pollution

The solution

● Buy a car that doesn't blow smoke?

Well, that's great if you can, but the amount of emissions can be reduced by having vehicles tuned and serviced regularly!

● There's another solution. Have you been converted?

We're talking **catalytic converters**. (Try saying that fast 10 times in a row!)

A catalytic converter is something on a car that looks a bit like a muffler and its job is to burn up pollutants. In many countries e.g. USA, Australia, Japan and Europe - it is law that cars must have catalytic converters. It's not law in New Zealand yet but it soon will be and then all new and imported cars must have one!

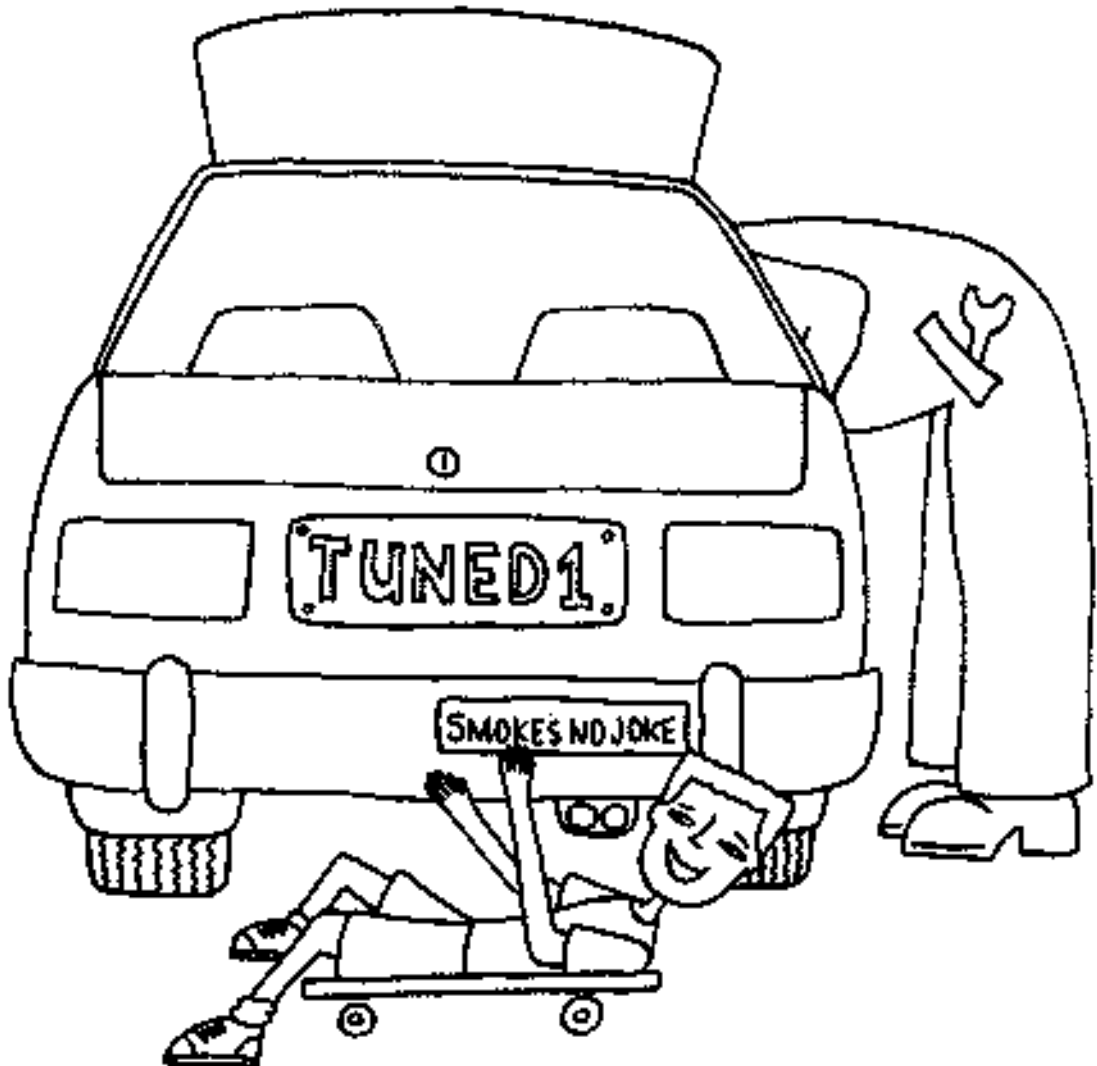
Sad to say some people have had the catalytic converter taken off their car because they think it makes the car go faster. Not so!

KEEP READING



What can you do about this?

- Invite a mechanic to your class to talk about vehicle tuning and servicing (and about catalytic converters)
- Encourage family members to have their vehicle tuned regularly
- Design and display a bumper sticker or poster with an eye-catching message about vehicle tuning
- Write and perform a funky, beep bop rap with a HUGE message for the community about vehicle tuning. (Perform this in assembly, down at the local library / community centre / shopping mall. This could be the start of a brilliant career!)



Travel Log

It's easy. It will be fun. It should give you some interesting information!

- Step One** Carry the log and a pencil with you wherever you go.
- Step Two** Record every trip you make. A trip occurs every time you leave home. Fill out the log as soon as possible.
- Step Three** Record the odometer readings for each car trip. (Ask for help if you don't know how to read the odometer).
- Step Four** Record the number of passengers in the car counts. (If you shared a ride this will reduce the number of kilometres you travelled).
- Step Five** Record the total kilometres for each car trip in the space provided.
- Step Six** For each ride-share trip, divide the number of kilometres travelled by two and write this amount in the box. If you didn't share the ride, do not divide by two.
- Step Seven** At the end of the day add up the kilometres for all trips to work out the days total. Transfer this figure for each day to the table below.

DAY OF THE WEEK	TOTAL DAILY KILOMETRES TRAVELLED
MONDAY	
TUESDAY	
WEDNESDAY	
THURSDAY	
FRIDAY	
SATURDAY	
SUNDAY	

Travel Log

NAME
DAY
Where did you go?
TRIP 1
TRIP 2
TRIP 3
TRIP 4
TRIP 5
When did you travel?
 Morning

 Morning

 Morning

 Morning

 Morning

 Lunchtime

 Lunchtime

 Lunchtime

 Lunchtime

 Lunchtime

 Afternoon

 Afternoon

 Afternoon

 Afternoon

 Afternoon

 Evening

 Evening

 Evening

 Evening

 Evening

How did you travel?
 Car

 Car

 Car

 Car

 Car

 Bus

 Bus

 Bus

 Bus

 Bus

 Train

 Train

 Train

 Train

 Train

 Ferry

 Ferry

 Ferry

 Ferry

 Ferry

 Taxi

 Taxi

 Taxi

 Taxi

 Taxi

 Bicycle

 Bicycle

 Bicycle

 Bicycle

 Bicycle

 Walk

 Walk

 Walk

 Walk

 Walk

 Other

 Other

 Other

 Other

 Other

If you travelled by car, did you ride-share?

(ride-share means sharing the ride with at least one other passenger in the car)

Travel Log

Continued

TRIP 1	TRIP 2	TRIP 3	TRIP 4	TRIP 5
What was the car odometer reading?				
At the start				
At the finish				
Total kilometres for each car trip				
For each ride-share trip divide the total kilometres by two and write in the result in the box below? If you didn't ride-share, transfer the total kilometres directly into the box (do not divide by two)				
Total kilometres of car trips for the day (Total daily kilometres travelled)				

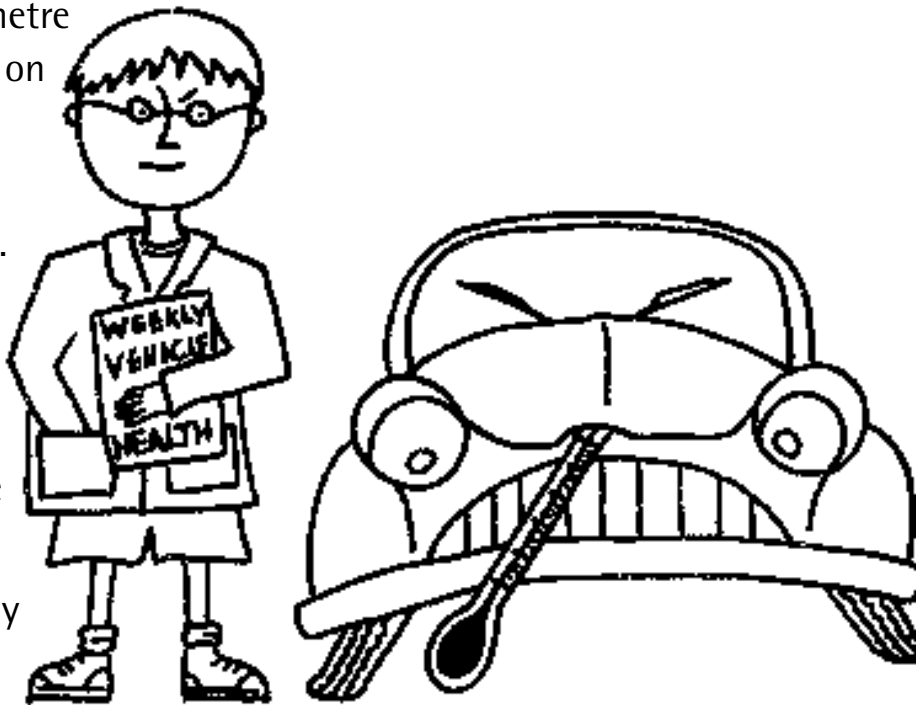
A diary of a week in the life of a car

This task is about helping you to:

- a** Find out the total number of kilometres your family car travels in a week.
- b** Consider how much pollution your car is producing.
- c** Start thinking about how to use the car less. (More about this later!)

What you have to do

- Record the odometer (kilometre counter) readings each day on the recording sheet.
- Record the daily kilometres travelled in the table below.
- Find out where the car went each day. Record this in the spaces provided.
- Tick the trips that you were in the car.
- Remember. A trip occurs any time the car leaves home - even if it is to go down to the dairy to buy bread and milk.
- Keep a record of what happens every day of the week.
- Work out how much air pollution your car has generated in one week. Record this.



Week in the life of a car

MONDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day
(Subtract start from end reading)

This is where the car went today
(don't forget to tick when you were in the car)

1 2 3 4

5 6 7 8

TUESDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1 2 3 4

5 6 7 8

WEDNESDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1 2 3 4

5 6 7 8

THURSDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1	2	3	4
---	---	---	---

5	6	7	8
---	---	---	---

FRIDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1	2	3	4
---	---	---	---

5	6	7	8
---	---	---	---

SATURDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1	2	3	4
---	---	---	---

5	6	7	8
---	---	---	---

SUNDAY

Odometer reading at the start of the day

Odometer reading at the end of the day

Total kilometres for the day

This is where the car went today

1	2	3	4
---	---	---	---

5	6	7	8
---	---	---	---

DAY OF THE WEEK	TOTAL DAILY KILOMETRES TRAVELLED
MONDAY	
TUESDAY	
WEDNESDAY	
THURSDAY	
FRIDAY	
SATURDAY	
SUNDAY	
TOTAL KILOMETRES FOR THE WEEK	

If each car produces approximately 2 kg of pollution each 35 kilometres travelled, how much has your car produced in one week?

Clean Air Drivers Quiz

Test a person who drives a car. Are they a Clean Air Driver?
Give them a copy of this sheet and circle their answer on the
Clean Air Driver-quiz score sheet to find out.

- A.** Are your tyres under inflated?
1. all tyres fine
2. one or more tyres under inflated
- B.** Does your car emit continuous tailpipe smoke that lasts for more than 10 seconds?
1. nothing
2. very little, lasts a few seconds
3. blue, black or white smoke
- C.** Check the service sticker on the windscreen. Is your car service up to date?
1. not yet due
2. overdue
- D.** Does your car have a catalytic converter?
1. yes
2. no
- E.** Is there any unnecessary excess weight inside the vehicle?
(Don't forget to check the boot)
1. no
2. yes
- F.** Are there any unnecessary attachments outside the car?
(Such as bullbars, roof racks, sun visors)
1. no
2. yes
- G.** In the last week, have you travelled without the car when possible?
1. several times
2. a few times
3. not at all
- H.** Do you carefully consider the necessity of each trip?
1. all of them
2. some of them
3. none of them
- I.** Do you plan and group trips together?
1. all of the time
2. some of the time
3. never
- J.** Do you car pool / share ride?
1. every opportunity I get
2. sometimes
3. never
- K.** Do you use local businesses and services?
1. where possible
2. sometimes
3. never
- L.** Do you turn the car air conditioner on?
1. only when its really hot.
2. every time I get in the car.
- M.** How would you describe your driving style?
1. smooth and even
2. stop-start
- N.** Do you drive over the speed limit?
1. no
2. yes
- O.** When you fill the petrol tank, do you stop at the first click?
1. yes
2. no

Clean Air Driver - quiz score sheet

Add up the scores to calculate the total. Use the key below to find whether the person tested is a Clean Air Driver, or whether they need to change their driving habits.

Clean Air Driver score sheet: write the names of the drivers and circle their answers.

Name						
A	1 2	1 2	1 2	1 2	1 2	1 2
B	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
C	1 2	1 2	1 2	1 2	1 2	1 2
D	1 2	1 2	1 2	1 2	1 2	1 2
E	1 2	1 2	1 2	1 2	1 2	1 2
F	1 2	1 2	1 2	1 2	1 2	1 2
G	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
H	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
I	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
J	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
K	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
L	1 2	1 2	1 2	1 2	1 2	1 2
M	1 2	1 2	1 2	1 2	1 2	1 2
N	1 2	1 2	1 2	1 2	1 2	1 2
O	1 2	1 2	1 2	1 2	1 2	1 2
Total						

Clean air driver results

Advice to give your driver

- 15 Excellent score. Congratulations, you are a clean air driver!
- 16-21 Just a few small changes away from being a clean air driver.
- 22-27 You need to reflect on your driving habits.
- 28-33 You need to seriously consider your driving habits.
- 34* Auckland's air needs your help now!

Weekly vehicle health check

- The following checklists apply to everyone in your household who owns or drives a car.
- Use a different coloured pencil or symbol for each driver's response.
- The information from these checklists will assist you in compiling a household action plan and communicating clean air messages to others.

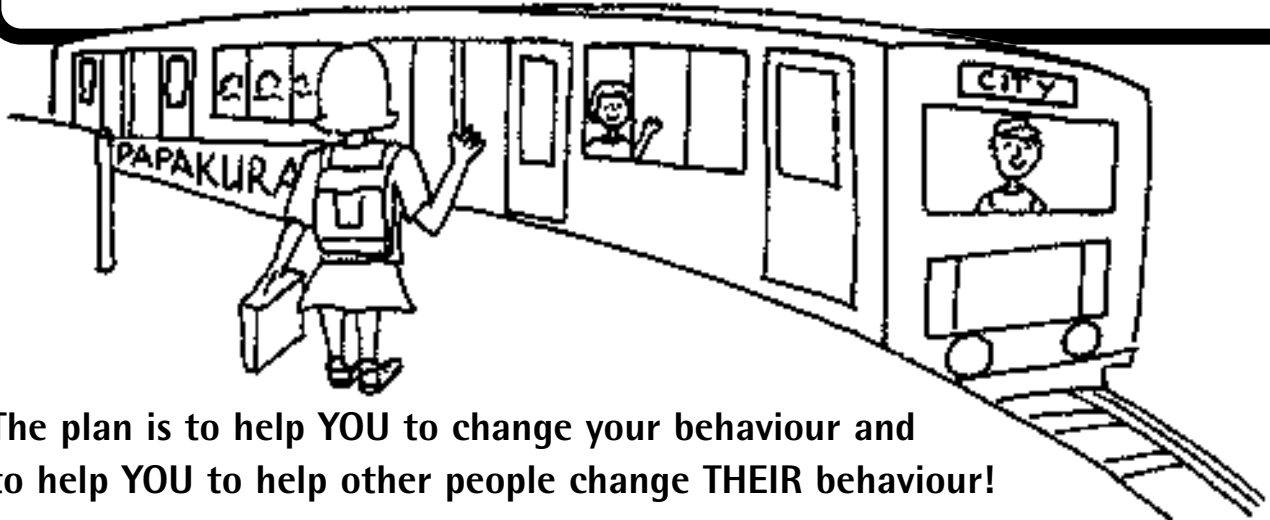
ACTION	WEEK 1	WEEK 2
Are your tyres under inflated?		
Does your vehicle have any visible emissions that last more than 10 seconds?		
Check the service sticker on the windscreen.		
Is your vehicle service up to date?		
Does your vehicle need a wheel alignment? (Steering pulls to one side or tyres are wearing unevenly)		
Is there any unnecessary weight in the vehicle?		
Are there any unnecessary attachments on the vehicle?		

Weekly driver habit check

ACTION - This week, where possible, have you:

	WEEK 1	WEEK 2
Travelled without a private vehicle?		
Carefully considered the necessity of each vehicle trip?		
Planned and grouped your trips together?		
Car pooled or shared with at least one other person?		
Used local businesses and services instead of driving out of the way for goods or services?		
Minimised the use of the vehicle air conditioner?		
Driven as evenly as possible, avoiding stop-start habits?		
Monitored the speed at which you drove, either at or under the limit?		
Stopped at the first click when filling the fuel tank.		

What's the plan, Stan?



The plan is to help YOU to change your behaviour and to help YOU to help other people change THEIR behaviour!

Really (honestly) the BIG plan is to get people to stop using their cars and to:

Walk

Cycle

Scoot

Skateboard

Rollerblade

Take a bus, train or ferry instead

Why? Reduced car use =
less exhaust emissions =
improved air quality!



But

It's hard to get people to stop using their cars because they are so convenient. What we can do is to help make people aware of the things they can do to reduce the air pollution.

Here are some messages you can put into action yourself, or that you could think about sharing with others and - or include in your Environmental Action Plan.

PLEASE use this list to sort out what you are going to do to help reduce air pollution!



- **Think carefully about whether the trip is really necessary.**
ASK yourself. DO I really need to make this trip by car? Are there other ways of getting to where I am going?
- **Plan trips and group them together to reduce cold engine starts.**
Cold engines produce more emissions. Combine trips with other family members.
- **Share rides and car pool to reduce the number of cars on the road.**
- **Use local businesses and services where possible.**
By shopping and doing business locally you could walk or cycle!
- **Keep the car regularly tuned and serviced.**
By doing this you can reduce the amount of pollution generated. If a vehicle has a smokey exhaust it probably means that it needs tuning!

Tuning a car regularly can:

- Improve performance
- Improve acceleration
- Increase fuel economy
- Maintain resale value
- Reduce harmful emissions

Keep tyres at the right pressure and properly aligned. This makes the car run more efficiently.

● **Drive evenly and avoid stop-start habits.**

Accelerating and braking heavily uses more fuel and increases the amount of emissions.

● **When putting petrol in the car only fill to the first click.**

This will stop fuel leaking or spilling. Leaked and spilt fuel turns into gas and becomes air pollution.

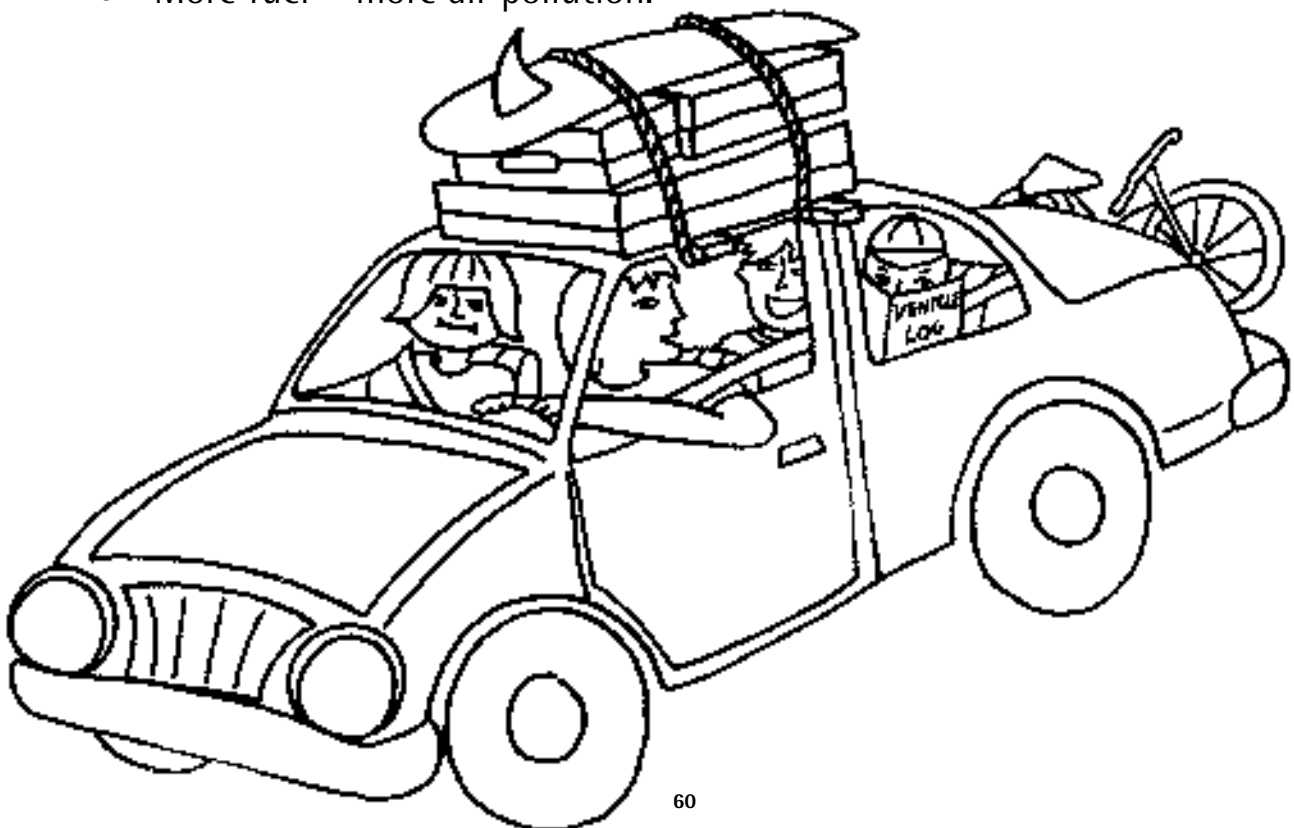
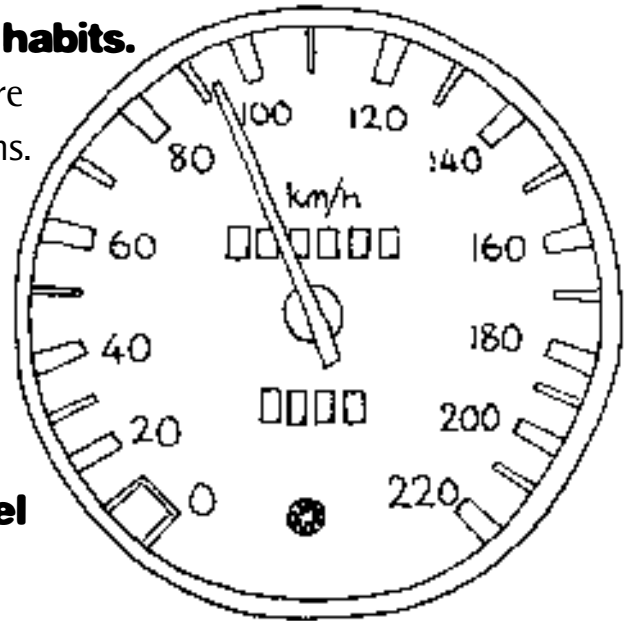
● **Keep to the speed limit, save fuel and generate less pollution.**

● **Only use the air conditioning when you absolutely have to (in hot and humid weather).**

Air conditioning uses more fuel and generates more air pollution.

● **Check the car to make sure no excess weight is being carried.**

- Excess weight increases fuel use.
- Roof racks, surfboards, bull-bars and sun visors also increase fuel use by changing the shape of the car and increasing friction.
- More fuel = more air pollution.



The heat is on!

The following activities are to help you to sort out information about two more 'hot' issues:

Domestic Fires

Backyard Burning



First things first

Read the information sheets, **Domestic Fires** and **Backyard Burning** one at a time. Complete one, two or more of these activities:

- Make a list of the key words. Check that you know the meaning of them.
If not - use a dictionary, a buddy or some other two-legged source of information to help you find the meaning.
- Find out what the 'by-laws' are in your local area that control backyard burning.
- Complete a PMI (Plus, Minus and Interesting points) about each issue:
 - No domestic fires
 - No backyard burning

STUDENT ACTIVITIES

- Write a persuasive speech or letter calling on the immediate banning of all domestic fires and backyard burning. Find ways of publicly sharing your views.
- Make a poster that will educate your family about these two important issues.
- Create a magnificent drama / role play about the 'Neighbours from Hell' whose smoky fires are driving you crazy.
- Complete two separate mind maps about the issues. Make sure you include what the problem is about and brainstorm some ideas about how it can be solved.
- Design some weird and wacky creations out of household rubbish that shouldn't be burned.
- Write (and publish) an Air Quality Care Code for the neighbourhood.



Y is for YOU taking action

about Domestic Fires and Backyard Burning!

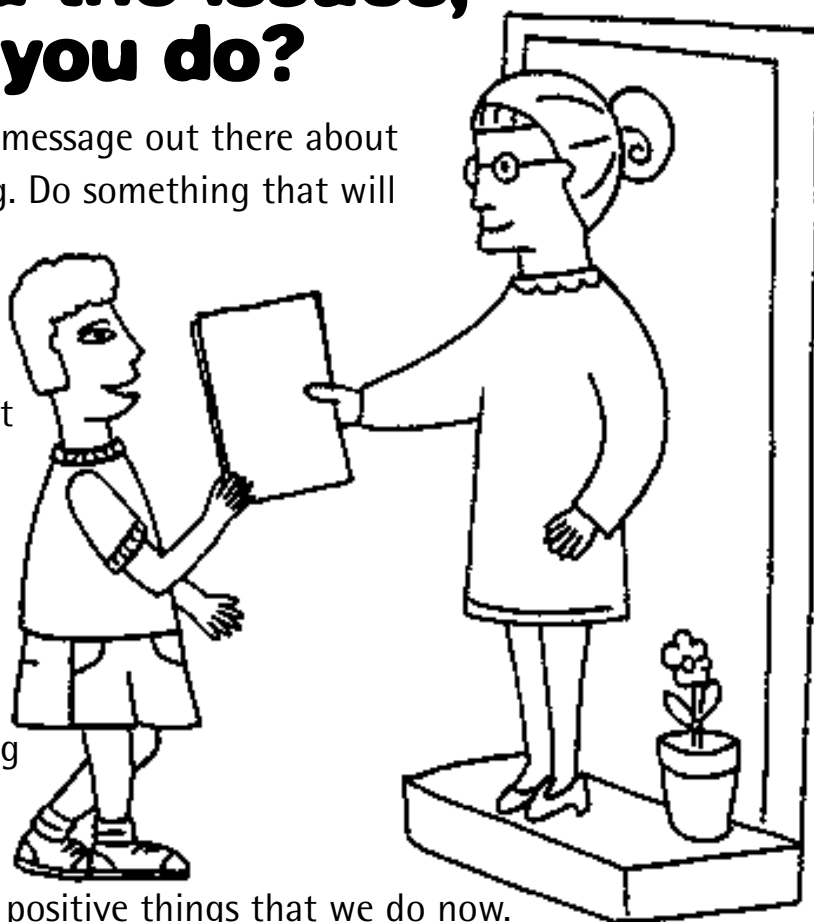
You've read the information, you understand the issues, now what can you do?

Do something that's real to get the message out there about domestic fires and backyard burning. Do something that will make a difference.

Stop and think

Not many people like to be told that they are doing something wrong.

You need to explain the reasons why something should be done differently. Explain how the environment and people's health can be improved by doing something about air pollution in the neighbourhood. Point out how, in the future, people will benefit from positive things that we do now.



Don't get people's backs up!

It's easier if messages are delivered in a positive, friendly way. Give positive suggestions for change e.g. present some ideas for alternatives to burning rubbish. Remind people about ways of keeping themselves warm without having the fire going.

Prepare this work at school and then complete at home

- Step One** Share with your family what you have learned about domestic fires, backyard burning and air quality.
- Step Two** Make a list of things you and your family can do to reduce air pollution around your home.
- Step Three** Write down the steps that the family needs to take to make these changes.
- Step Four** Put names beside tasks that need doing e.g. stack the firewood properly so it dries well, recycle more rubbish.
- Step Five** Put the list where everyone will see it e.g. fridge door, toilet wall
- Step Six** Create eye-catching reminders about positive things that can be done around the house e.g. keep doors closed when the fire is going.

Taking the message into the community

Your work on air quality issues wouldn't be complete if you didn't get involved in taking the message about air pollution and ways to reduce it into the community.

Use the Environmental Action Planner and Community Action Checklist to help you decide how you are going to tell the community about air quality and what they can do to make a difference.

Put your planning into action because you can make a difference and you can help others to make a difference. Don't settle for living in a soup forty years from now.

Do something!

Some ideas to get you started

- Design a bumper sticker.
- Write and decorate information sheets about vehicle emissions, domestic fires and backyard burning. Deliver them around your neighbourhood.
- Create posters with strong messages about making a difference to air quality. Display these in the local library, dairy, community / shopping centre.
- Design a logo or a slogan. Use it!
- Create a home page (web site) on the net or create a link from the schools homepage.
- Make a banner with a strong message about air quality. Display this in a prominent public place.
- Speak at local community group meetings.
- Write, record and perform a song about air quality.
- Get onto talk back radio to be interviewed about the issues that are concerning you.
- Ask a well-known person or celebrity to endorse your message.
- Put messages in the school newsletter.
- Write a letter to the editor of your local newspaper.
- Write an article and ask the local paper to publish it or do a feature on air quality.
- Write and perform a drama or role-play that has strong environmental messages. Perform this in and around the community.



Community action checklist

Use the following checklist to help you effectively plan what you are going to do to tell the community about air pollution and things we can all do to reduce it.

Which group of people would you like to make more aware about air quality?

- Adults
- Other students
- Other groups _____

What message do you want to get across about air pollution?

(You can chose more than one).

- General air pollution facts
- Air pollution in Auckland
- Facts about the motor vehicle and air pollution
- Air pollution and domestic fires
- Air pollution and backyard burning
- How to reduce air pollution
- Other information _____

What do you think is the best way to reach this group of people with your message?

- Through the school newsletter
- At school assembly
- Through the local paper
- Putting up a display at your local shopping centre or on your school notice board
- Other ways _____