Future air quality in Victoria – interim report

Seeking a cleaner future

The quality of the air we breathe is important, because air pollution can affect our health. EPA Victoria is responsible for outdoor air quality, which can be affected by industry, transport, business, and domestic activities. Sometimes air quality can also be affected by natural events such as dust storms and bushfires.

EPA is currently working together with CSIRO on a project to investigate the likely trends in Victoria's air quality over the next few decades. Focusing on Melbourne and Geelong, the study will also examine which pollution sources will have the greatest effect on future air quality.

This information will be used to develop policies for effective control of air pollution into the future. EPA's aim is that everyone in Victoria will be able to enjoy clean air.

What is air quality?

Air quality refers to the nature of the air we breathe, and how it affects us. In this study, we look at chemical pollution of the air. In particular, we examine those common air pollutants which are known to affect our health:

- **Particles:** These come in all different shapes and sizes. Very small particles (a few thousandths of a millimetre) can get into our lungs, causing a range of health problems especially for young children and those with existing lung or heart disease.

- **Ozone (O_3):** A gas like oxygen (O_2), but with an extra atom making it very reactive. Ozone is harmful to the lungs, especially for the elderly and those with asthma.

- **Nitrogen dioxide (NO_2):** This gas is produced by the burning of fuels, such as natural gas, petrol or diesel. It is harmful to health especially for children, the elderly and those with asthma.

- **Carbon monoxide (CO):** This odourless gas, mainly from petrol exhaust, can get into the bloodstream where it displaces oxygen. It can cause heart problems, especially in the elderly.

- **Sulfur dioxide (SO_2):** This gas is produced in coal-fired power stations and metal smelting operations. It can irritate the lungs, and is particularly harmful for people with asthma.

- **Air toxics:** This term refers to a range of toxic gases, such as benzene and formaldehyde, which exist in very small concentrations but are highly toxic.

In sufficient concentrations, any of these air pollutants can be harmful to humans. Even in Australian cities where air pollution is reasonably well controlled, studies have shown that some people may be seriously affected. A day of poor air quality can increase the number of people who attend hospital with lung and heart problems; children with asthma and elderly people with existing health issues are most at risk.

How is air quality changing?

EPA has measured Melbourne's air quality every day since 1979. These measurements clearly show that our air quality has improved over this time. Over the last 15 years, pollutants from motor vehicle exhaust have continued to reduce, despite significant increases in the number of vehicles on our roads.

Some air pollutants, especially ozone and particles, are affected by a wide range of sources. These pollutants are changing more slowly, and we still experience occasional days of poor air quality in summer (due to ozone) and winter (due to particles).

Poor air quality in Melbourne on a day of light winds

As well as measuring air quality, EPA has also been managing all major sources of air pollution. So whilst we still experience poor air quality days in Melbourne, the number of days has reduced significantly since monitoring began.

Predicting future trends

Emissions

To study trends in air quality, emissions of air pollutants have been estimated for a base year (2006) and a future year (2030). An emissions "inventory" for 2006 was prepared using a detailed study of all transport activity, major industries, small business and domestic activity. By carefully examining trends in population, industry and transport, emissions in the year 2030 have also been estimated.

As with any attempt to predict the future, there are uncertainties in these estimates. To provide a realistic picture of the range of possible futures, three alternative scenarios have been prepared:
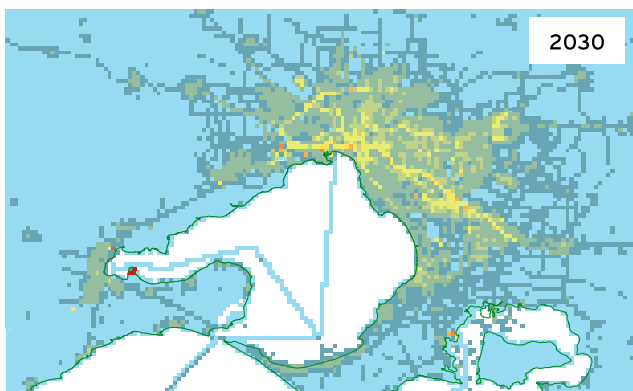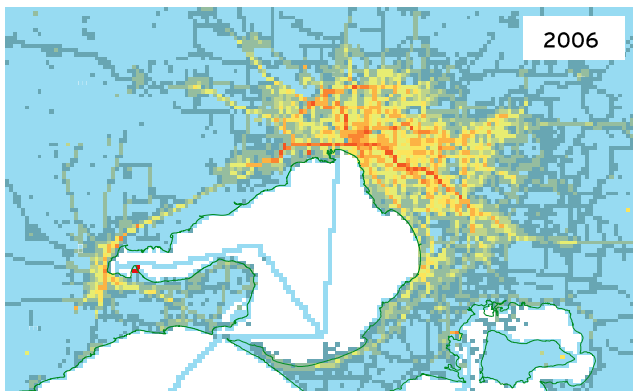
E1: a low emissions scenario
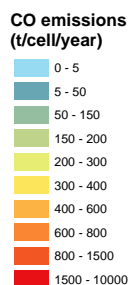
E2: a medium emissions (most likely) scenario

E3: a high emissions scenario.

For 2006 and each of the 2030 scenarios, a map of pollution emissions across Victoria was prepared, plus a more detailed map for the Melbourne area.

The following figure shows estimated emissions of carbon monoxide for 2006 and 2030 (for the most likely scenario). Emissions from road transport, shipping and industry can be seen in these maps. We can also see that road transport emissions are predicted to reduce in future, due to cleaner exhausts.

Carbon monoxide emissions: 2006 vs. 2030

CO emissions (t/cell/year)

|	
	0 - 5
	5 - 50
	50 - 150
	150 - 200
	200 - 300
	300 - 400
	400 - 600
	600 - 800
	800 - 1500
	1500 - 10000

Weather

Weather has a very important effect on air pollution levels. During light winds, pollutants can build up in the air, creating a blanket of pollution. Temperature, sunlight and rain also have important effects on air pollutants.

In this project weather data have been obtained from global climate projections undertaken by CSIRO. Weather information has been carefully scaled down to provide details for Victoria and Melbourne.

In south-east Australia it's very common for the weather to vary significantly from year to year. For this reason, 10 years of weather data have been gathered for each scenario. For example, climate projections for the years 2025-2034 have been used to study air quality in 2030.

The following image shows an example of the kind of weather data used in this study. The white arrows refer to winds, with longer arrows representing stronger winds. This example shows that winds can be quite different in different locations around Melbourne. A detailed understanding of weather conditions helps EPA understand how pollutants move around in the environment.
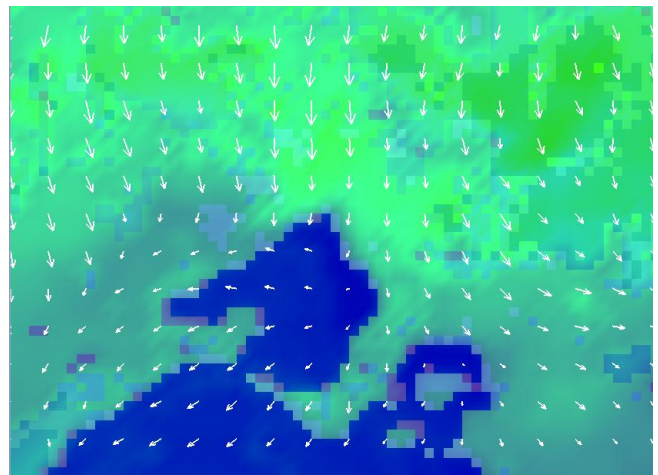
Example of weather data over Melbourne

Population

Strong population growth has been forecast for Victoria. This will affect domestic and transport emissions, and has been accounted for in the emissions inventories used in this project. Population growth also has important implications for air quality impacts.

An increase in population means an increase in the number of people exposed to pollutants. This, in turn, increases public health costs to the community. We also need to consider any trends in where people live and how they might be exposed to air pollution.

As well as growing, our population is also getting older. By 2030, we will have more than twice the number of people aged 65 and above in Melbourne. People in this age category tend to be more sensitive to air pollution, so this will need to be considered in future policy development.

Putting it all together

By combining emissions, weather and population data using an air quality model, it is possible to predict air quality impacts. The model used in this study has been developed and refined over many years, and has been tested against EPA's measurements of air pollution in Melbourne.
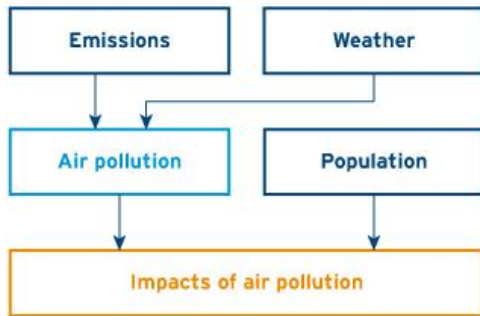
The model is now being used to estimate air pollution in 2006 and 2030. This will allow an assessment of the likely future trends in air quality impacts in Victoria. These calculations are still in progress and a full report will be published later in 2012.

The study separately considers the effects of a changing climate on air pollution - using climate data supplied by CSIRO for the years 2030 and 2070, and assuming pollutant emissions remain constant. This is being done because variations in weather, including air temperature, will affect air pollution. For example, previous studies have consistently found that ozone pollution in cities is likely to get worse in a warming climate.

A final stage of the project will involve a study of dust storms and bushfires. These events can occasionally result in very high levels of air pollution. Research will be conducted to see whether it is possible to predict future dust storm and bushfire activity in Victoria.

Preliminary findings

Key findings from the project so far are:

o Climate change is expected to have a small effect on Melbourne's air quality by 2030, but a larger effect by 2070. The main effect is an increase in summer ozone pollution.

o Continuing improvements to motor vehicle emissions will significantly reduce the impacts of carbon monoxide, nitrogen dioxide and air toxics by 2030. As motor vehicle exhausts become cleaner, other sources of pollution, such as industry and business operations and residential activity, will become relatively more important.

o Emissions from large industrial sources are well managed through environmental legislation, and this will continue into the future. For example, most sulfur dioxide emissions in Melbourne and Geelong are from power stations and smelters, but measurements show that sulfur dioxide levels in these regions are very low.

o Ozone and particles will continue to be pollutants of concern in 2030. Some improvement is expected in peak concentrations, but net impacts may be higher because of population growth. Also, as medical treatments continue to extend our lives, more people will be vulnerable to air pollution in future.

Clean air: let's work together

A wide range of activities result in air pollution. In any large city, emissions from our daily actions can build up to cause significant impacts. This research project will help minimise future impacts, by providing evidence to support state and national policy development.

EPA is committed to its role in reducing air pollution.

For information on how you can help reduce air pollution, visit EPA's website **www.epa.vic.gov.au.**