VICTORIA'S AIR QUALITY – 2002

Publication 910

July 2003

OVERVIEW

- In 2002, Victoria's air was generally clean. In an international context Melbourne's air quality (compared to similar urban centres) remains relatively good, consistent with results from recent years.
- Carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide and lead levels met the environmental quality objectives designed to protect human health.
- The 2008 goal for particles (as PM_{10}) was met at all air monitoring stations except Geelong South. While most exceedences were caused by dust storms, PM_{10} remains an issue for the entire Melbourne-Geelong region, with the objective being exceeded on eight days.
- The 2008 goal for visibility was not met. In the Melbourne-Geelong region, 31 days in 2002 did not meet the objective for visibility. In the Latrobe Valley, 15 days in 2002 did not meet the objective.
- Smoke from domestic wood heaters is the greatest contributor to visibility reduction during autumn and winter.
- The Melbourne-Geelong region had five smog events in 2002, a number typical of recent years.

AIR QUALITY IN DETAIL

Why EPA Monitors

EPA monitors air quality in order to ensure that the health and well-being of Victorians are maintained. Monitoring provides information on the concentration of pollutants in the air. This enables assessment of air quality relative to objectives; informs the development of air quality management strategies; and allows evaluation of the effectiveness of air quality management activities.

What EPA Monitors

EPA monitors a range of pollutants with known health impacts. Air quality objectives are set in the *State Environment Protection Policy - Ambient Air Quality* (SEPP (AAQ)) for seven common pollutants. Health objectives are set for:

- ***carbon monoxide (CO)*** – a gas readily absorbed into the bloodstream that affects transport of oxygen through the body. People suffering from cardiovascular disease are particularly at risk.
- ***ozone (O_3)*** – an oxidant that impacts on the respiratory system. Exposure to ozone can result in increases in asthma attacks and hospitalisations for heart and lung conditions.
- ***nitrogen dioxide (NO_2)*** – affects the respiratory system and the body's defence mechanisms. This can lead to increases in hospitalisations and respiratory infection, particularly in children.

- ***sulfur dioxide (SO_2)*** – an irritant gas that affects the respiratory system. Asthmatics are particularly sensitive to sulfur dioxide.
- ***lead (Pb)*** – long term exposure can affect development in children.
- ***particles smaller than 10 micrometre (PM_{10})*** – these particles (about one tenth the width of human hair) can exacerbate existing respiratory and cardiovascular disease. This can lead to increases in hospitalisations and premature mortality.

These health objectives are consistent with the National Environment Protection Measure (NEPM) – Ambient Air Quality.

An aesthetic standard is also set in the SEPP (AAQ) for:

- ***Visibility reducing particles*** - these particles reduce visual distance and aesthetic enjoyment. Commonly referred to as visibility, its reduction is typically associated with particles less than 2.5 micrometre ($PM_{2.5}$). These particles can penetrate deeply into the lungs.

EPA also measures oxides of nitrogen, methane, non-methane hydrocarbons and fine particles (as $PM_{2.5}$) to develop further understanding of the sources of air pollutants and their behaviour in the environment.

How EPA assesses the air monitoring results

Air quality for 2002 has been assessed against the SEPP (AAQ). The SEPP specifies both objectives and goals. Objectives are a quantifiable characteristic of the air against which air quality can be assessed (typically a pollutant concentration). The objectives are set at levels that protect beneficial uses, including:

- human health and well-being,
- visibility, and
- aesthetic enjoyment and local amenity.

Goals in the SEPP specify the maximum permissible number of exceedences of the objectives per year and a timeframe in which this goal must be met (by 2008). The goals guide the formulation of strategies for the management of human activities that may affect the environment.

As the incidence of elevated levels of pollutants is significantly dependent on weather conditions, comparisons in this report with 2001 data are only given where appropriate.

Where EPA Monitors

EPA Victoria's air monitoring program recorded more than two million air quality measurements in 2002 from 18 sites (15 in the Melbourne-Geelong region, two in the Latrobe Valley region and one in Ballarat - see Figure 1). EPA continued to update and expand the air monitoring network during 2002, with:

- A new air monitoring station opening at Mooroolbark in May 2002 (monitoring O_3, NO_2, CO, PM_{10}, $PM_{2.5}$ and meteorological parameters).
- Ozone monitoring commencing at an existing meteorological station at Melton (October 2002).
- Continuous particles monitoring (PM_{10}) commencing at Geelong South (in September 2002), RMIT (October 2002), Moe (November 2002) and Traralgon (November 2002).

- Monitoring for ozone commencing in August 2002 at a site in Pakenham for a period of nine months.
- Monitoring for PM_{10} commencing at Ballarat in February 2002 for a period of 18 months.

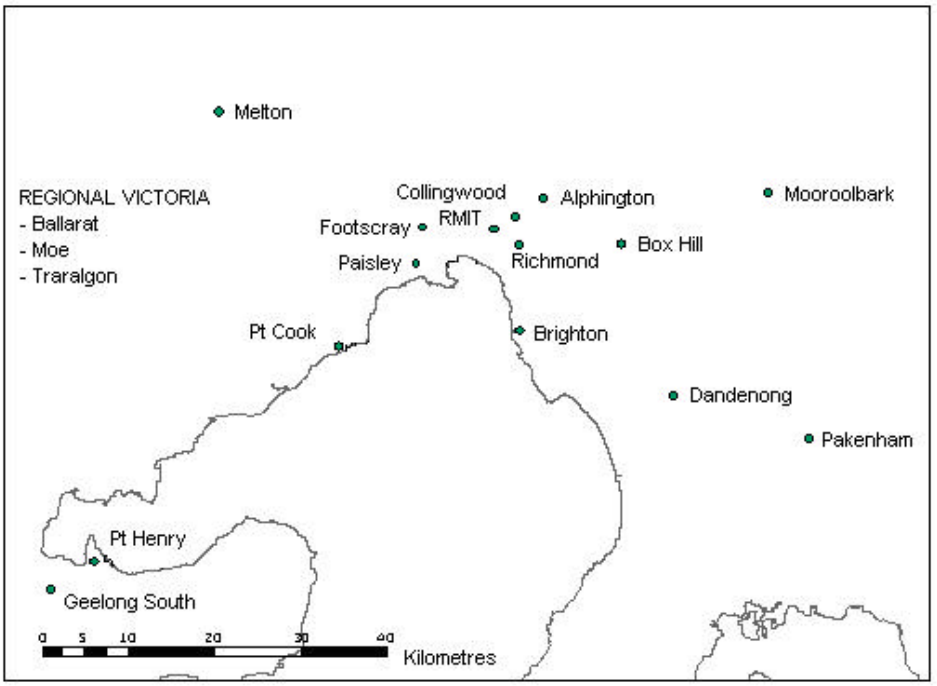


Figure 1: EPA Air Monitoring Stations in Victoria

PREDOMINANT TYPES OF POLLUTION

The two predominant types of pollution episodes in Victoria are summer and winter smog.

Summer smog

Summer smog contains chemicals called oxidants, the main one being ozone. Ozone is formed from complex reactions of pollutants such as hydrocarbons and oxides of nitrogen, with strong sunlight. Due to Melbourne's topography (a trapped water body with surrounding low mountains), high ozone levels can occur when light winds and temperature inversions in the morning are followed by afternoon sea breezes. The greatest single contributor to ozone formation is the motor vehicle, notably emissions from cold engines during short trips in the average motor vehicle.

The 1-hour and 4-hour policy objectives for ozone are 0.10 parts per million (ppm) and 0.08 ppm respectively. These levels are designed to protect community health. Days where levels are greater than the environmental quality objective are referred to as exceedences. The SEPP 2008 goals are no more than one exceedence per year for each of the 1-hour and 4-hour objectives.

Winter smog

Winter smog generally occurs when there is a build up of particles from combustion sources. These particles are trapped in the atmosphere under still weather conditions, mainly during autumn and winter. EPA monitors a number of different indicators of these particles. One method measures visibility reduction, which is expressed as an Airborne Particle Index (API). Studies show a reasonable agreement between API and concentration of particles smaller than 2.5 micrometre ($PM_{2.5}$).

The API is related to Local Visual Distance by a simple inverse ratio. The SEPP 2008 goal for visibility states that Local Visual Distance should not be below 20km (equivalent to 2.35 API units) on more than three days in any year.

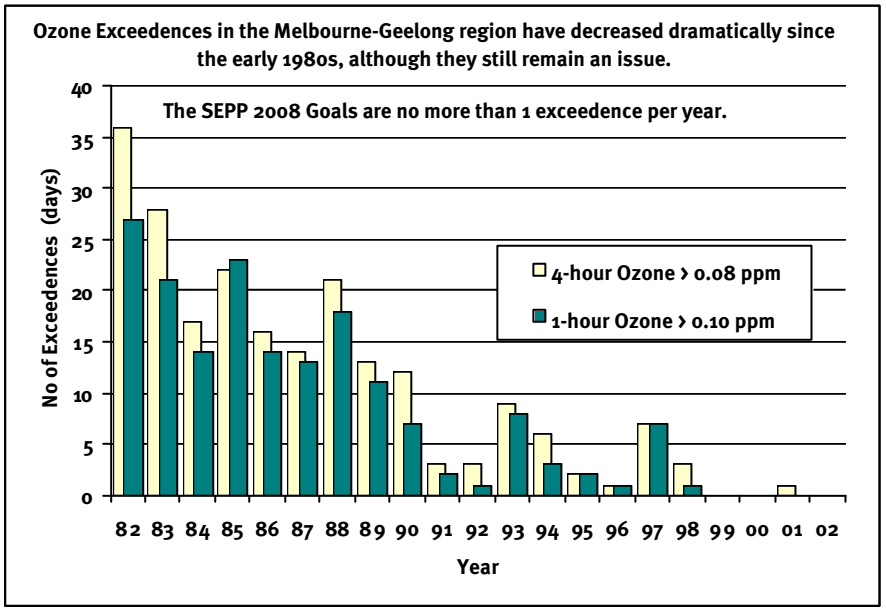
AIR QUALITY IN 2002 [1]

Ozone met the 2008 goals

In 2002, the SEPP 2008 goals for ozone were met in the Melbourne-Geelong region, with no exceedences of the 1-hour or 4-hour objectives. Air quality in the Melbourne-Geelong region has not always met the SEPP 2008 goals for ozone but these problems are now less frequent (the 20-year trends are shown in Graph 1).

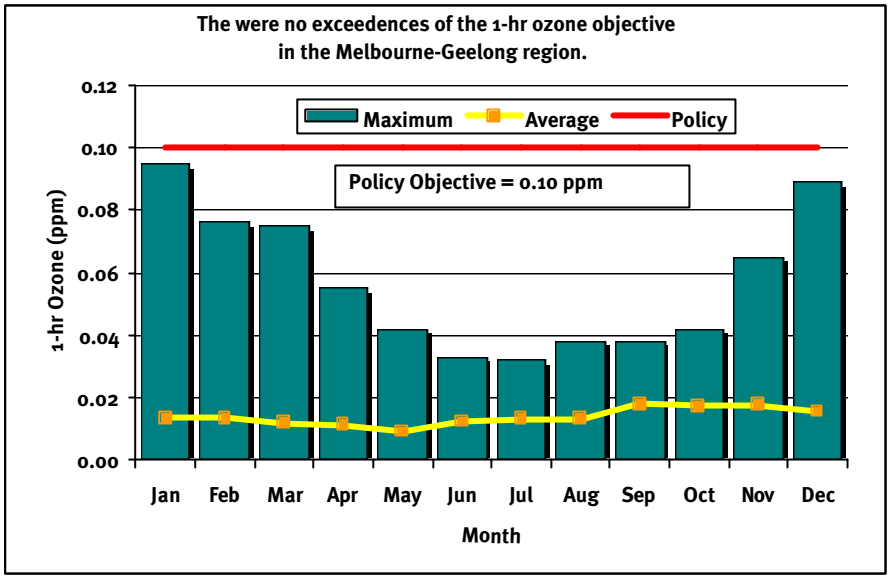
In 2002, there were no exceedences of the 1-hour and 4-hour ozone objectives in the Latrobe Valley. Ozone exceedences in the Latrobe Valley are rare.

The monthly 1-hour ozone readings for the Melbourne-Geelong region are shown in Graph 2, and for the Latrobe Valley in Graph 3. Ozone data can be downloaded from the EPA website.



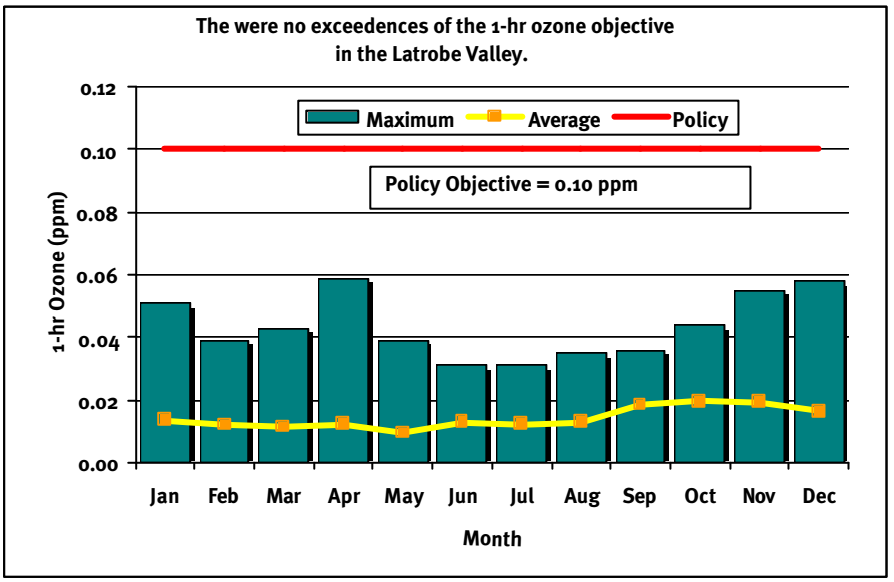
Graph 1: 20-year trend in 1-hour and 4-hour average Ozone exceedences in the Melbourne-Geelong region

[1] The 2002 air monitoring data can be downloaded from the EPA website at www.epa.vic.gov.au/air/air_monitoring_report_2002/



Graph 2: Maximum and Average 1-hour average Ozone

Melbourne-Geelong region in 2002

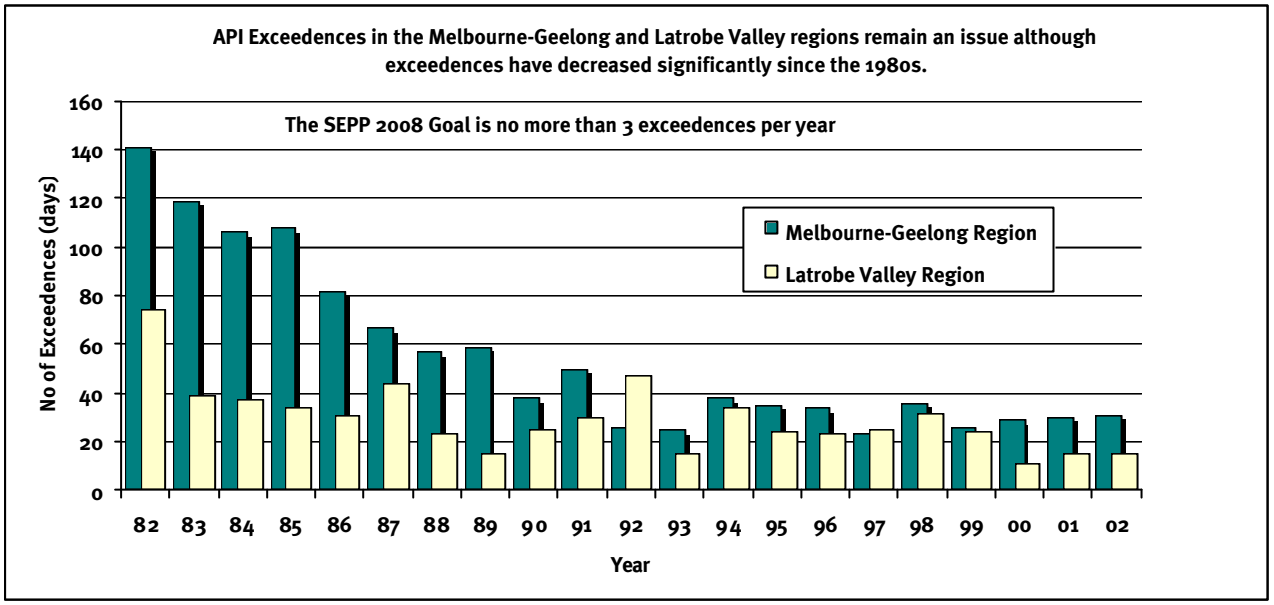


Graph 3: Maximum and Average 1-hour average Ozone

Latrobe Valley in 2002

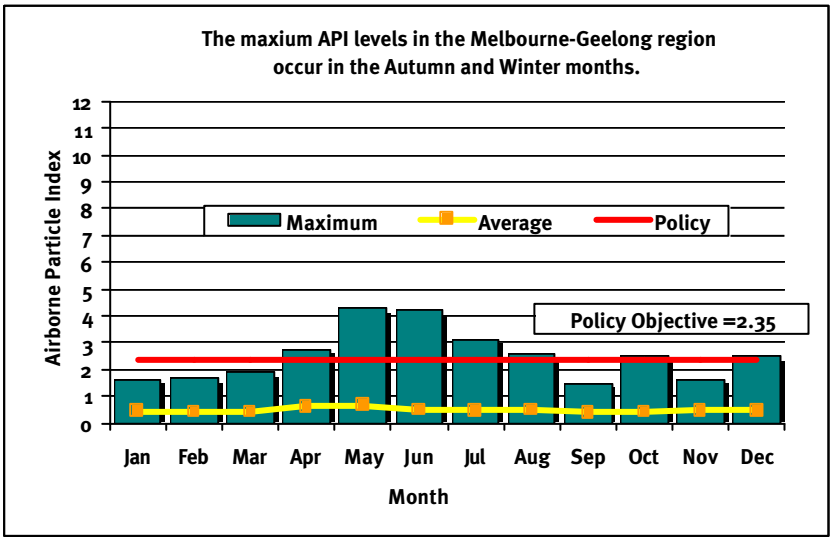
Visibility did not meet the 2008 goal

While air quality does not always meet the SEPP 2008 goal for the 1-hour visibility objective, these problems are now less frequent in the Melbourne-Geelong and Latrobe Valley regions (the long term trends are shown in Graph 4). Improvements are a direct consequence of controls placed on industry, motor vehicles, and backyard burning and the efforts of the community in response to EPA education and communication programs.

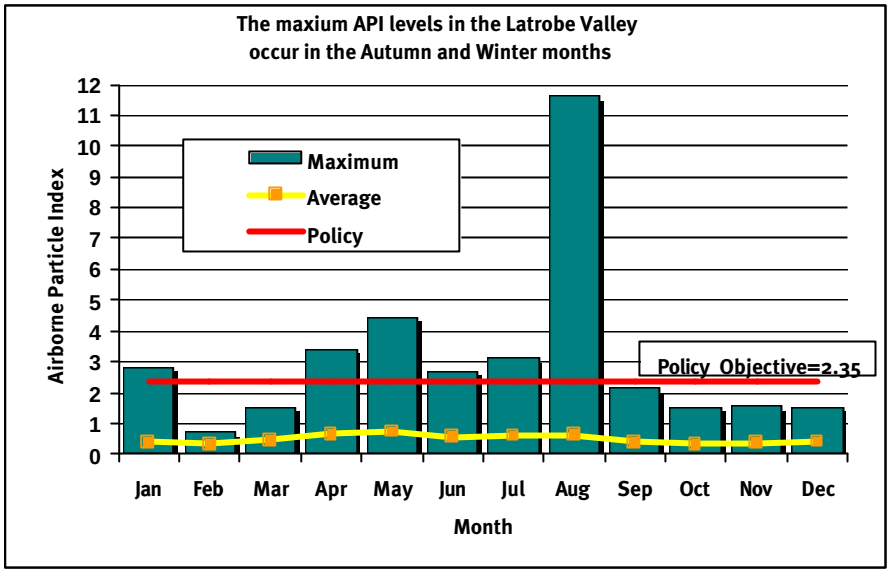


Graph 4: 20-year trend in 1-hour average API exceedences in the Melbourne-Geelong and Latrobe Valley regions

The highest monthly 1-hour API readings for the Melbourne-Geelong region are shown in Graph 5, and for the Latrobe Valley in Graph 6. There were 31 exceedences measured in the Melbourne-Geelong region (compared to 30 in 2001) and 15 in the Latrobe Valley (compared to 15 in 2001). API data can be downloaded from the EPA website.

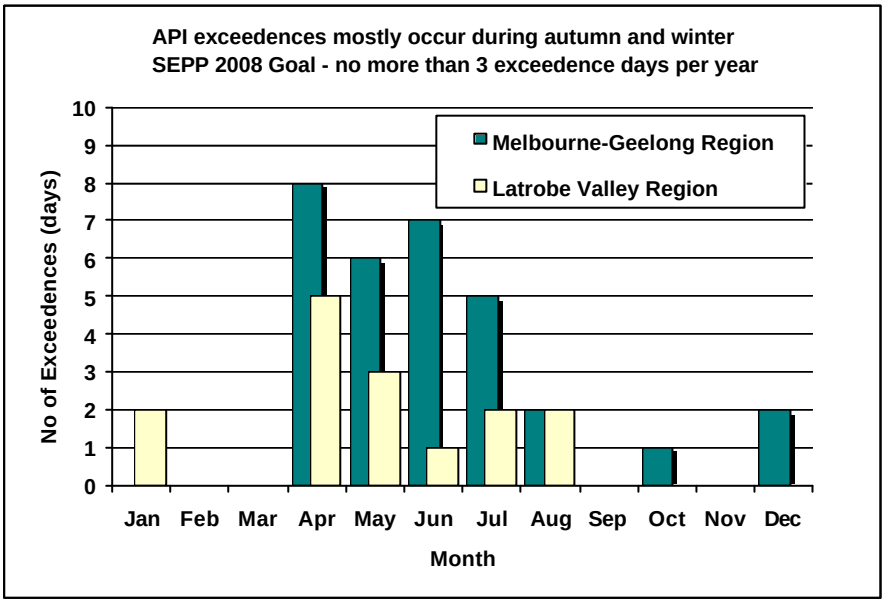


Graph 5: Maximum and Average 1-hour average Airborne Particle Index in the Melbourne-Geelong region in 2002



Graph 6: Maximum and Average 1-hour average Airborne Particle Index in the Latrobe Valley in 2002

A yearly distribution of API exceedences for both regions is shown in Graph 7. These indicate that most API exceedences occur during autumn and winter.



Graph 7: 1-hour average API exceedences in the Melbourne-Geelong and Latrobe Valley regions in 2002

According to a recent inventory of pollution sources within the Melbourne-Geelong region, the greatest contributor to elevated particle levels during autumn and winter is domestic solid fuel heaters without emission reducing technology (for example old wood heaters) and open fires. Limiting the use of these heating methods will help reduce future pollution events, especially on smog alert or still weather days.

Particles (PM_{10}) met the 2008 goal, except at Geelong South

EPA also monitors for particles with a diameter of less than 10µm (PM_{10}). The SEPP 2008 goal specifies there should be no more than five exceedences per year of the daily average objective of 50 micrograms per cubic metre (µg/m^3).

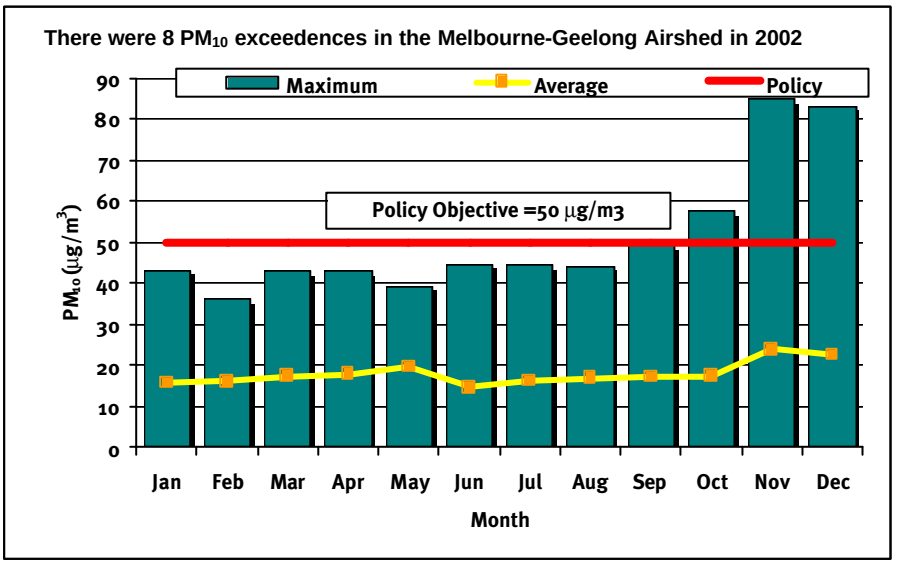
The 2002 monitoring data complied with the 2008 goal except at the Geelong South monitoring station, where six exceedences of the objective were observed. In the Melbourne-Geelong region the objective level was exceeded in total on eight days, namely:

- a dust storm on 29 December causing exceedences at all operating stations;
- a widespread wind blown dust event on 12 November causing exceedences at Geelong South, RMIT and Footscray;
- an additional four exceedences at Geelong South in October/November, also caused by wind blown dust; and
- two exceedences at Dandenong in November, probably due to local activities.

In comparison, the objective was exceeded in the Melbourne-Geelong region on three days in 2001.

As the objective continues to be exceeded, PM_{10} remains an issue for the entire Melbourne-Geelong region.

Monthly variation of average da ily and maximum daily PM_{10} levels is shown in Graph 8. Details of the year's data can be found on the EPA website.



Graph 8: Maximum and average daily PM_{10} in Melbourne-Geelong region in 2002

In 2002, PM_{10} monitoring commenced in:

- the Latrobe Valley (since November 2002). No exceedences were recorded.
- Ballarat (since February 2002). One exceedence was recorded on 15 September.

Other pollutants met the 2008 goals

In 2002, there were no exceedences of the SEPP objectives for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead. Details of these measurements are available on the EPA website.

One smog alert was issued

EPA issued one smog alert in the Melbourne-Geelong region during 2002. Smog alerts are issued when forecast meteorological conditions are conducive to the build up of pollutants over the Melbourne-Geelong region.

There were five smog events.

There were five smog events in Melbourne in 2002 (compared to six in 2001). A smog event occurs when:

- visibility becomes less than 20km, for at least one daylight hour, as recorded by at least two monitoring stations; or
- a primary pollutant (carbon monoxide, sulfur dioxide or particles as PM_{10}) exceeds an objective as recorded by at least two monitoring stations; or
- a secondary pollutant (1-hour ozone or nitrogen dioxide) exceeds an objective at any station in the EPA network.

One smog event in April and two in May occurred due to visibility-reducing particles. Another two smog events (PM_{10} exceedences) occurred due to wind blown dust, one in November and the other in December. A list of all the smog events can be found on the EPA website at www.epa.vic.gov.au/Air/Bulletins/smogevents.asp

OTHER HIGHLIGHTS

- Day to day air quality (as an air quality index) continues to be reported on EPA's website, and in *The Age* and *Herald Sun*. Daily summaries and air quality forecasts were made available through the EPA Pollution Watch Line (03 9695 2777 or 1800 444 004).
- A new web site (Air Quality for Kids) will enable direct interrogation of EPA's air quality database. While targeted at school children, it will enable easy access to both current and historical data for all members of the public.
- EPA continued its use of the mobile air monitoring laboratory to facilitate monitoring of 'hot spots'. In 2002, monitoring occurred at Corio (Princes Highway) and Yarraville (Francis Street).
- The Mt Cottrell air monitoring station was decommissioned, with instrumentation relocated to Melton.
- The Australian Air Quality Forecasting System (AAQFS), a collaborative project of EPA Victoria, EPA New South Wales, Bureau of Meteorology and CSIRO, is currently being trialed within EPA to determine how it might be integrated into EPA's current forecasting procedures.
- In preparation for the proposed $PM_{2.5}$ NEPM, EPA monitored $PM_{2.5}$ at five locations across Melbourne.

RELATED EPA PUBLICATIONS

Ambient Air Quality in the Port Phillip Control Region, 1979-1993: Compliance and Observed Trends, Publication 468, EPA 1995.

Air Monitoring Data 1992-95, Publication 584, EPA 1997.

Air Emissions Inventory Port Phillip Region, Publication 632, EPA 1998.

Ambient Air Quality NEPM Monitoring Plan Victoria, Publication 763, EPA 2001

Air Monitoring Report 1999, Publication 773, EPA 2000.

Air Monitoring Report 2000, Publication 778, EPA 2001.

Air Monitoring Report 2001, Publication 852, EPA 2002.

State Environment Protection Policy (Ambient Air Quality), Victorian Government Gazette No. S19, 09/02/1999 (Amended in Dec 2001).