ENVIRONMENT REPORT

AIR MONITORING AT BALLARAT, AUGUST 2005 TO AUGUST 2006

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SUMMARY

As part of EPA Victoria's commitment to protecting the environment, we are conducting an air quality monitoring campaign to better identify and understand the issues faced in different regions, such as Ballarat.

A mobile air monitoring station (see Figure 1) monitored air quality in Ballarat from August 2005 to August 2006. Several common pollutants with known health impacts were monitored.

Ballarat's air quality was generally similar to or better than other monitored regions in Victoria (Melbourne, Geelong and the Latrobe Valley).

The results showed that Ballarat had generally good air quality but was locally impacted by bushfires and, on colder evenings, contributions from domestic woodsmoke.

BACKGROUND

To enhance our knowledge and understanding of air quality in regional Victoria, EPA is undertaking a series of monitoring studies focused on major regional centres. The Ballarat study involved extensive, continuous monitoring of a variety of gaseous and particle pollutants. Prior to this study, we conducted 12 months of monitoring in Bendigo[1]. We moved the mobile air monitoring station to Warrnambool in October 2006 as a continuation of the regional air quality monitoring campaign.

The City of Ballarat, with a population approaching 90,000, is located 441 m above sea level at the end of the Great Dividing Range, 110 km north-west of Melbourne. Ballarat experiences a temperate climate with four seasons, characterised by warm summers and cool to cold winters (4 °C is a typical minimum overnight temperature in winter).

1. What do we know about Ballarat's air quality?

Previous EPA air quality monitoring in Ballarat has been limited to particle monitoring (as PM_{10}) from February 2002 to September 2003[2]. The monitoring was for 24-hour periods every sixth day. The results showed that Ballarat had generally good air quality. The air quality objective for particles was met except for two occasions, which were attributed to windblown dust.

2. What are the sources of pollution in Ballarat?

Based on EPA's emissions inventory[3], the main source of particles in Ballarat is windblown dust. Although reticulated natural gas is available in Ballarat, wood heaters are still used, causing woodsmoke to be a source of fine particles in winter.

Motor vehicles also emit fine particles and are Ballarat's main sources of carbon monoxide and nitrogen oxides. Motor vehicles also contribute to the formation of ozone in Ballarat. Ozone is not emitted directly from any source, but is formed from the reaction of nitrogen oxides with volatile organic compounds (VOCs). In Ballarat, VOCs come mostly from vegetation.

Ballarat has only a few, relatively small industrial sources of pollutants.

Figure 1: Mobile air monitoring station in Ballarat

[1] The Bendigo air monitoring report (EPA publication 1041) is available for download from the publications section of EPA's website, www.epa.vic.gov.au/publications.

[2] The 2002–03 Ballarat air monitoring report, EPA publication 936, is available for download from the publications section of EPA website, www.epa.vic.gov.au/publications.

[3] The emissions inventory is a stocktake of what sources of pollutants there are in each region of Victoria.

Emissions of common air pollutants in Ballarat are generally lower than in Melbourne and Geelong, and similar to Bendigo, so we expect air quality objectives to be met for most pollutants.

3. Where and when did EPA monitor?

A mobile air monitoring station was used to continuously monitor air quality in a residential area of Ballarat at Midlands Reserve on Doveton Street (see Figure 2). We monitored over a 12-month period, from 1 August 2005 to 1 August 2006.

Figure 2: Ballarat monitoring site

4. What did EPA monitor?

The pollutants monitored included particles smaller than 10 micrometres (PM_{10}), visibility measured as an airborne particle index (API, as an indicator of very fine particle levels), carbon monoxide, nitrogen dioxide, and ozone.

5. How did we interpret the monitoring results?

The maximum and average concentrations measured for each pollutant over the 12-month monitoring period at Ballarat are presented in this report.

Levels were compared against Victorian and Australian air quality *objectives*[4]. The objectives are set at levels that protect human health and aesthetic enjoyment.

Comparisons are given to levels monitored in Melbourne, Geelong and the Latrobe Valley[5] over the same time period (based on averages from all stations in each region).

Pollutant levels have also been compared against EPA's Air Quality Index[6]. Levels that do not meet the air quality objectives are reported as Poor or Very Poor.

FINDINGS

6. Air quality in Ballarat is generally good.

During the 12 months of monitoring at Ballarat, air quality objectives were met on 92 per cent of days, with the Air Quality Index[6] being Good to Very Good on most days. Days where the objectives were not met were a result of poor visibility, caused by fine particles.

7. Smoke from wood heaters and bushfires led to days with poor visibility.

Visibility did not meet the objective[7] on a total of 30 days of monitoring. For comparison, during the same time period, the number of days that Melbourne stations did not meet the visibility objective ranged from 10 to 36 days.

Woodsmoke from domestic heating influenced Ballarat's visibility (contributing to 23 of the 30 poor visibility days). Other causes were bushfires (five days) and unidentified combustion sources (two days).

The majority of times when the visibility objective was not met occurred on cold autumn and winter nights, when wood heater use is at its greatest. On nights with little or no wind, emissions of fine particles accumulate and reduce visibility.

An example of a winter visibility event is shown in Figure 3. On 26 July 2006 temperatures dropped during the early evening and home heating use would have increased. The temperature decreased further overnight as calm conditions developed, contributing to the build-up of smoke and fine particles, resulting in the visibility objective not being met. This event continued into the early hours of 27 July with the air quality objective for visibility also not being met on this day. The evening of 27 July shows similar temperatures but higher wind speeds, which resulted in better dispersion and subsequently better visibility (lower API readings). A similar pattern of accumulation and dispersion was also evident in the levels of carbon monoxide monitored during these times, as is expected when particles are from combustion sources.

[4] *State Environment Protection Policy (Ambient air quality)* (SEPP), Victoria Government Gazette No. S19, 9 Feb 1999 (amended Dec 2001). *National Environment Protection Measure for Ambient Air Quality,* National Environment Protection Council publication, available from www.ephc.gov.au.

[5] Carbon monoxide is not monitored in the Latrobe Valley.

[6] The EPA Air Quality Index (overview available from www.epa.vic.gov.au/air/bulletins – click on 'About Air Quality Bulletins').

[7] API equal to 2.35, equivalent to a 20 km visual distance.

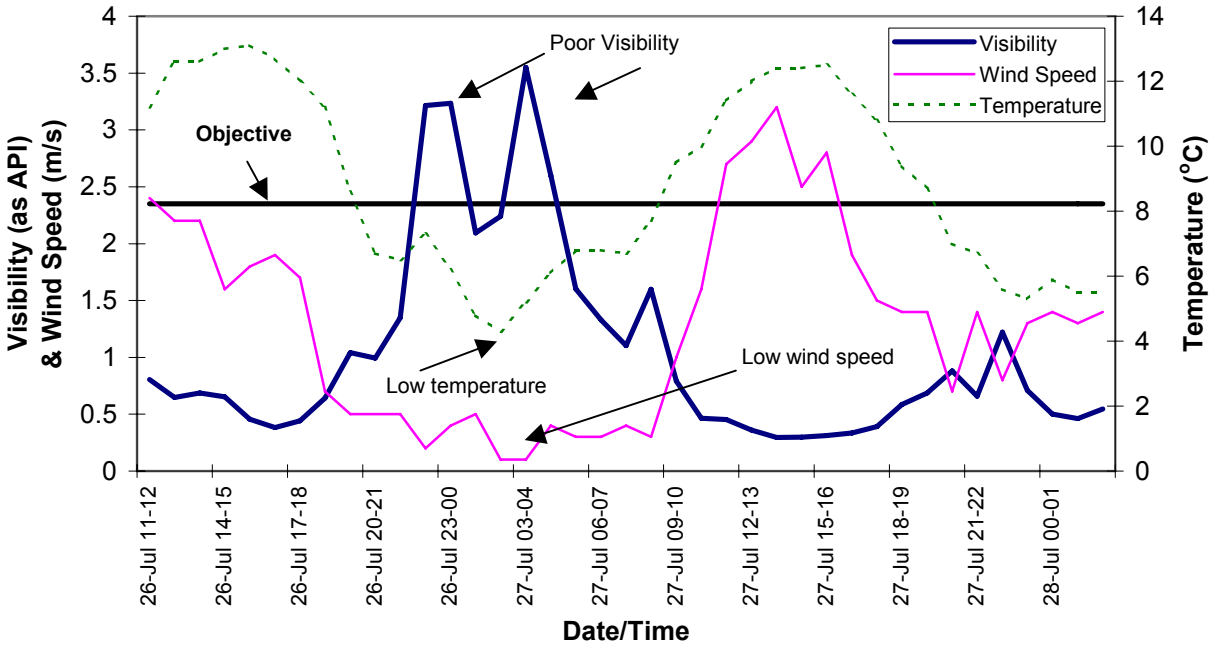

Figure 3: Visibility did not meet the objective on cool winter evenings of 26 and 27 July 2006

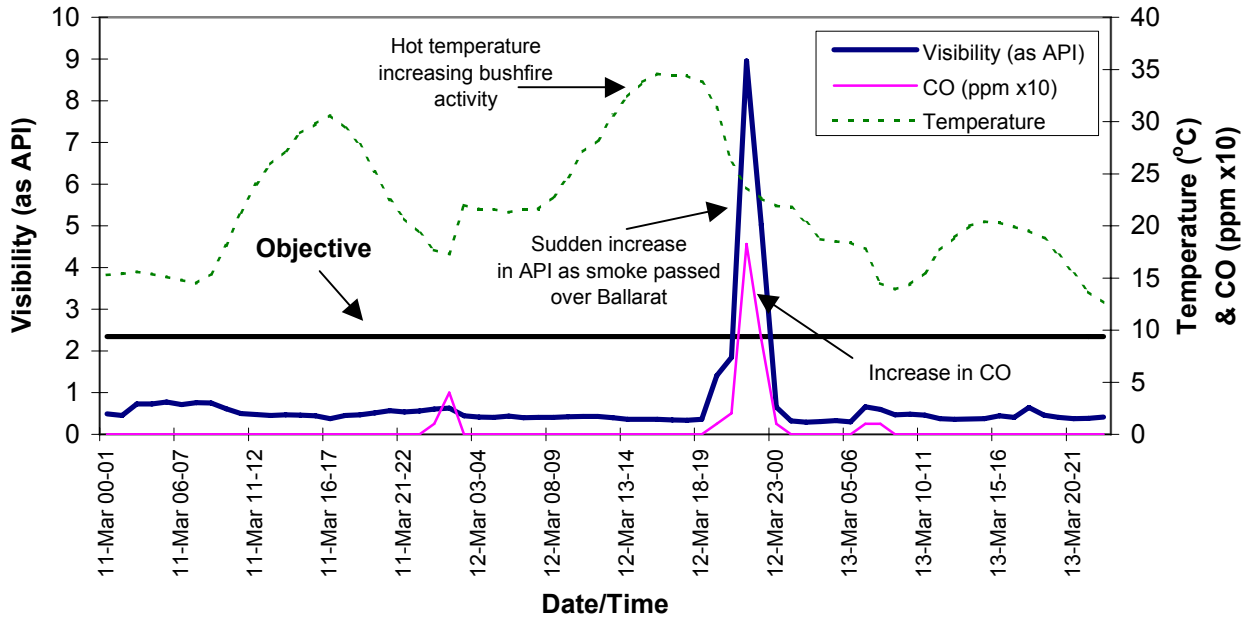

Figure 4: Visibility did not meet the objective on 12 March 2006 due to the Snake Valley bushfire

Bushfires also caused the visibility objective to not be met on five days. An example of this is the Snake Valley fire to the west of Ballarat on 12 March (see Figure 4). Approximately 3300 hectares were burnt in the Snake Valley region, impacting on local air quality and causing the visibility objective to not be met. Smoke from the fire was initially driven away from Ballarat by hot, northerly winds. At approximately 7:00pm, however, a cool change moved across the region and the wind shifted to a south-westerly direction. This resulted in the bushfire smoke moving relatively quickly over Ballarat, causing a sudden drop in visibility (an increase in API).

As expected for a smoke plume from a fire, carbon monoxide levels also spiked at this time. While the air quality objective for visibility was not met, the 24-hour particles objective was met, as the smoke passed through Ballarat relatively quickly (with particle levels only elevated for one hour).

8. Particle pollution met the objectives

Particles (as PM_{10}) met the air quality objectives for all days measured and on average was similar to the levels measured during the previous monitoring campaign during 2002-03.

9. Particle levels and visibility in Ballarat were similar to other regions

Figures 5 and 6 show that average particle (as PM_{10}) and visibility levels were similar between Ballarat, Melbourne, Geelong and the Latrobe Valley.

Figure 7 shows visibility levels for Ballarat and Melbourne. Apart from the local differences caused by bushfires during January, February and March both areas followed similar trends. This is most evident during the winter months when visibility is impacted by an increase in fine particle pollution.

The poorest visibility level in Ballarat was similar to peak levels in Melbourne and the Latrobe Valley, and higher than the peak levels in Geelong. Maximum particle levels in Ballarat, however, were lower than the other three regions.

Although different years were monitored, Ballarat's average particles and visibility levels were similar to those recorded in Bendigo during the 2004-05 monitoring campaign.

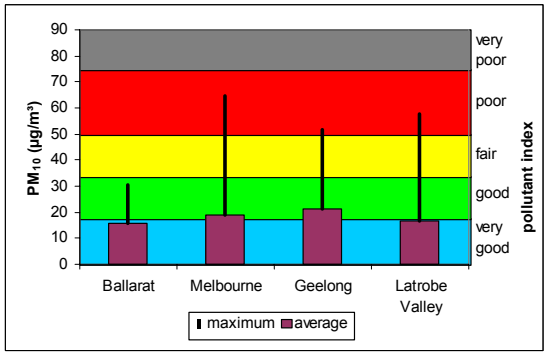

Figure 5: 24-hour PM_{10} (objective 50 µg/m³)

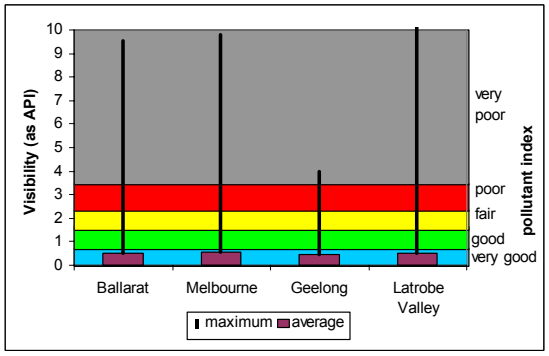

Figure 6: 1-hour visibility (objective API 2.35)

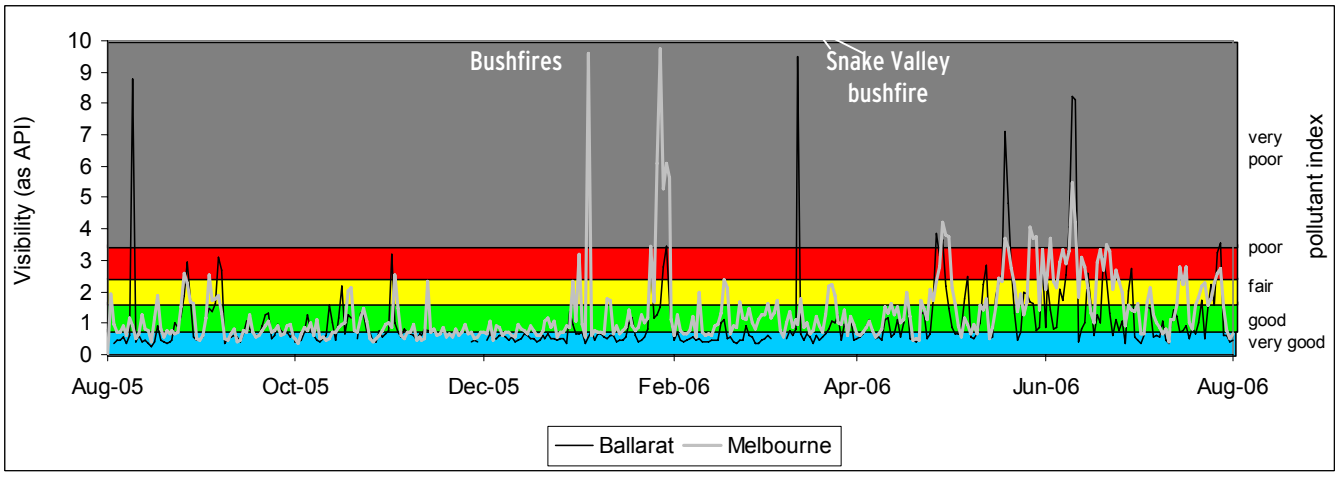

Figure 7: Daily minimum visibility (i.e. maximum 1-hour API)

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10. Gaseous pollutants met the objectives

Figures 8 to 10 show that the maximum carbon monoxide, nitrogen dioxide and ozone levels at Ballarat all met the air quality objectives. Air quality for these pollutants was Good to Very Good at all times.

As expected, the monitoring indicated that, in summer, carbon monoxide and nitrogen dioxide levels were generally lower, due to better dispersion and more efficient operation of catalytic converters in cars. Ozone concentration was lower in winter due to lower levels of sunlight.

11. Ballarat's gaseous pollutant levels were similar to or lower than other regions

The maximum and average carbon monoxide levels in Ballarat were lower than levels in Melbourne, and similar to levels in Geelong (Figure 8).

The maximum and average nitrogen dioxide levels in Ballarat were similar to levels in Geelong and the Latrobe Valley, and lower than levels in Melbourne (Figure 9).

Ballarat's maximum ozone level was lower than peak levels in Melbourne and Geelong. The average ozone levels in the four regions were similar, with Ballarat being slightly higher (Figure 10). These results are consistent with lower population and vehicle traffic in Ballarat.

Although different years were monitored, Ballarat's maximum and average gaseous pollutant levels were similar to those recorded in Bendigo during the 2004-05 monitoring campaign.

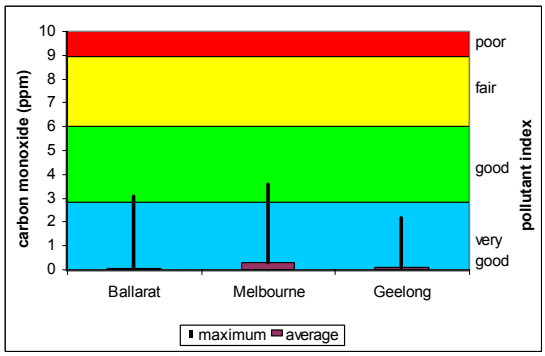

Figure 8: Eight-hour carbon monoxide (objective 9 ppm)

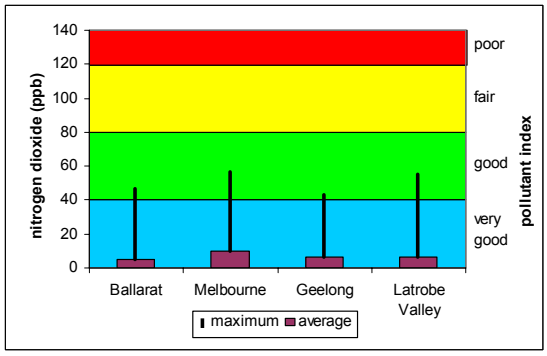

Figure 9: One-hour nitrogen dioxide (objective 120 ppb)

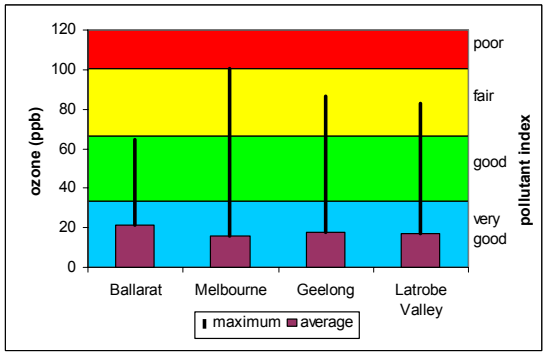

Figure 10: One-hour ozone (objective 100 ppb)

CONCLUSIONS

Twelve months of monitoring showed that Ballarat's air quality was generally good, with 92 per cent of the days monitored meeting the air quality objectives. Ballarat's air quality was similar to or better than that experienced in Melbourne, Geelong and the Latrobe Valley.

The visibility objective was not met on 30 days of monitoring, with domestic woodsmoke and bushfires the main contributors.

Carbon monoxide, nitrogen dioxide, ozone and particles (as PM_{10}) all met the air quality objectives during the 12 months of monitoring in Ballarat.

In residential areas of Victoria, it is not uncommon during the colder months of the year for visibility to not meet the air quality objective. EPA is working closely with local councils to educate the community on the use and impacts of domestic wood heaters.

Information on reducing smoke impacts from your wood heater can be found on the EPA website[8], including:

- guidance on the selection, purchase, installation and maintenance of wood heaters
- tips for efficient wood heater operation, including advice on firewood selection
- details of the Victorian Government Gas Heater Rebate Scheme, an incentive program providing subsidies for the replacement of wood heaters by high-efficiency gas heaters
- guidance on what to do if your neighbours have excessively smoky wood heaters.

ACKNOWLEDGEMENTS

EPA Victoria would like to acknowledge the City of Ballarat Council for its assistance and for allowing the location of the mobile air monitoring station in Midlands Reserve.

[8] Tips to reduce wood smoke and other information on wood heaters is available at www.epa.vic.gov.au/air/woodheaters. Information on current gas rebates can be found at http://www.sustainability.vic.gov.au/