ENVIRONMENT REPORT

AIR MONITORING AT ELTHAM, APRIL 2005 TO APRIL 2006

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SUMMARY

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

A mobile air monitoring station was used to monitor air quality in Eltham from April 2005 to April 2006. Several common pollutants with known health impacts were monitored.

Eltham's air quality was generally similar to or better than other areas in Melbourne and Victoria (Geelong and Latrobe Valley).

The results show that Eltham had generally good air quality but was impacted by contributions from domestic woodsmoke and motor vehicle emissions on cold evenings in winter.

BACKGROUND

EPA is undertaking a series of monitoring programs to gain a better understanding of air quality issues in the metropolitan and major regional centres in Victoria. The Eltham study involved extensive monitoring of a variety of gaseous and particle pollutants.

Etham is a suburb in the Shire of Nillumbik located approximately 25 kilometres north-east of central Melbourne. The Shire covers an area of 432 square kilometres and has an estimated population of around 60,000. Similarly to other Melbourne suburbs Eltham experiences a temperate climate with cool to cold winters. Temperatures during the monitoring program ranged from 0 to 43 °C.

What are the sources of pollution in Eltham?

Based on EPA's emission inventory[1], woodsmoke is a major source of particles in Eltham. Although reticulated natural gas is available in Eltham, wood heaters are still used, causing woodsmoke to be a source of fine particles in winter.

Motor vehicles also emit fine particles and are major sources of carbon monoxide and nitrogen oxides in Eltham. Motor vehicles also contribute to the formation of ozone. Ozone is not emitted directly from any source in the area, but is formed from the reaction of nitrogen oxides with volatile organic compounds (VOCs). In Eltham VOCs come mostly from motor vehicles, wood heaters, small industry and vegetation.

Where and when did EPA monitor in Eltham?

Air monitoring was conducted using a mobile air monitoring station in the playground at East Eltham Primary School (Figure 1). This site was chosen because it was typical of a residential area of Eltham. Monitoring was performed over a 12-month period from 20 April 2005 to 19 April 2006.

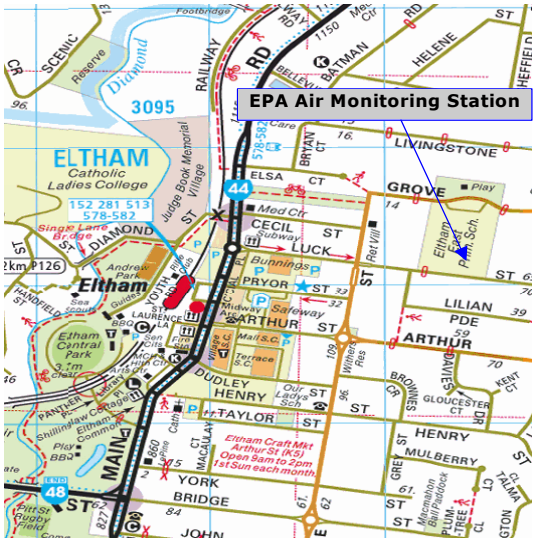

Figure 1: Eltham monitoring site

What did EPA monitor?

The pollutants monitored included particles smaller than 10 micrometres (PM_{10}), particles smaller than 2.5 micrometres ($PM_{2.5}$), carbon monoxide, nitrogen dioxide, ozone, benzene, benzo(α)pyrene, formaldehyde, toluene and xylene.

How did EPA interpret the monitoring results?

The maximum and average concentrations measured for each pollutant over the 12-month monitoring period at Eltham are presented in this report. Concentrations are reported as annual, 24-hour and four-hour averages as appropriate for comparison to State and national objectives.

[1] The emissions inventory is a stocktake of pollution sources in each region of Victoria.

PM_{10}, carbon monoxide, nitrogen dioxide and ozone levels were compared against Victorian air quality objectives[2]. $PM_{2.5}$ levels were compared against the national advisory reporting standard[3]. The objectives are set at levels that protect human health and aesthetic enjoyment. Benzene, benzo(α)pyrene, formaldehyde, toluene and xylene levels were compared against health-based 'monitoring investigation levels' specified in the National Environment Protection Measure (Air Toxics)[4]. The objectives, national advisory reporting standard and monitoring investigation levels will be referred to as objectives in this report.

Comparisons are made to levels monitored in Melbourne, Geelong and the Latrobe Valley based on averages from all stations in each region unless specified otherwise. Some comparisons are made where monitoring was conducted during different time periods. Although seasonal and inter-annual variation is expected, indicative comparisons can be made based on the typical levels at different locations.

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

FINDINGS

Air quality in Eltham is generally good.

During the 12 months of monitoring at Eltham, air quality objectives were met on 95 per cent of days, with the Air Quality Index being Good to Very Good on most days. Days when the objectives were not met were mainly a result of elevated particle levels.

Particle levels were occasionally elevated.

PM_{10} did not meet the air quality objective on a total of 16 days of monitoring. Most of the days when PM_{10} went above the objective were during April and May 2005. $PM_{2.5}$ did not meet the air quality objective on a total of nine days during June 2005. PM_{10} and $PM_{2.5}$ levels measured at Eltham are shown in Figure 2.

Soil at the site led to elevated PM_{10} levels.

The most likely cause of the high PM_{10} levels was dust from the school playground. On these days PM_{10} levels peaked at 11:00 and 13:00, coinciding with school recess times. These peak events ceased once mulch was placed over the playground and it rained. The dust was very localised and would not have impacted significantly on air quality away from the site.

A combination of woodsmoke and motor vehicle emissions led to elevated $PM_{2.5}$ levels.

The most likely cause of higher $PM_{2.5}$ levels was a build-up of motor vehicle emissions and woodsmoke from domestic heating. Higher $PM_{2.5}$ levels occurred mostly on cold winter nights when there was little or no wind. Cold temperatures result in increased use of wood heaters and more particle pollution. With little or no wind, particles from all sources including wood heaters and motor vehicles accumulate. The combination of cold temperatures and light or no wind therefore results in higher particle levels.

Further evidence supporting conclusions about the contribution of combustion sources (such as wood heaters and motor vehicles) causing elevated $PM_{2.5}$ levels is as follows:

- The highest carbon monoxide levels occurred at the same time as high particle levels.
- PM_{10} consisting mainly of $PM_{2.5}$ on these days.

Both of these observations are expected when particles are from combustion sources.

[2] State Environment Protection Policy (Ambient air quality) (SEPP), Victoria Government Gazette No. S19, 9 Feb 1999 (amended Dec 2001).

[3] Variation to the National Environment Protection (Ambient Air Quality) Measure for particles as $PM_{2.5}$, available from www.ephc.gov.au.

[4] National EnvironmentI Protection ((Air Toxics) Measure 2004, National Environmental Protection Council publication, available from www.ephc.gov.au.

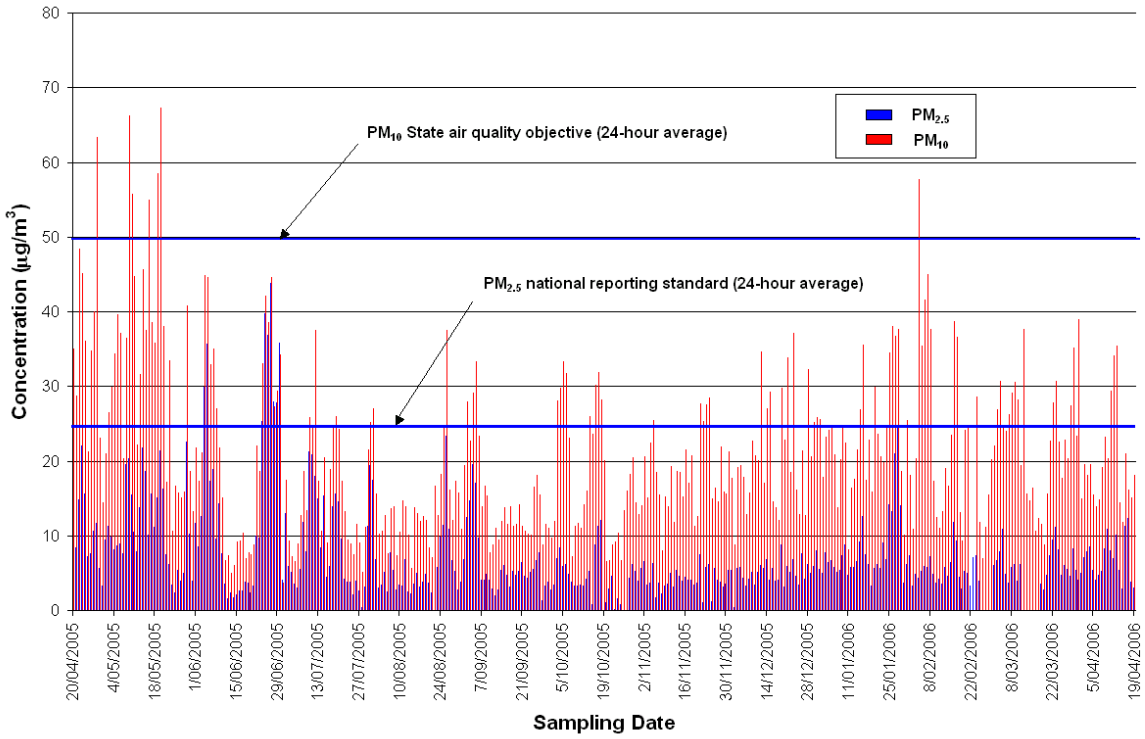

Figure 2: 24-hour PM_{10} and $PM_{2.5}$ levels

Particle levels in Eltham were similar to other areas

Figure 3 and 4 show that average particle levels were similar to other areas of Melbourne, Geelong and the Latrobe Valley. Maximum $PM_{2.5}$ levels were higher than in other areas of Melbourne. Higher $PM_{2.5}$ maximum levels were most likely a result of higher levels of woodsmoke from the use of wood heaters in Eltham. Maximum PM_{10} levels were similar to levels in Melbourne and Latrobe Valley but lower than Geelong.

Average particle levels in Eltham ranged from good to very good and maximum concentrations from poor to very poor when compared against EPA's Air Quality Index.

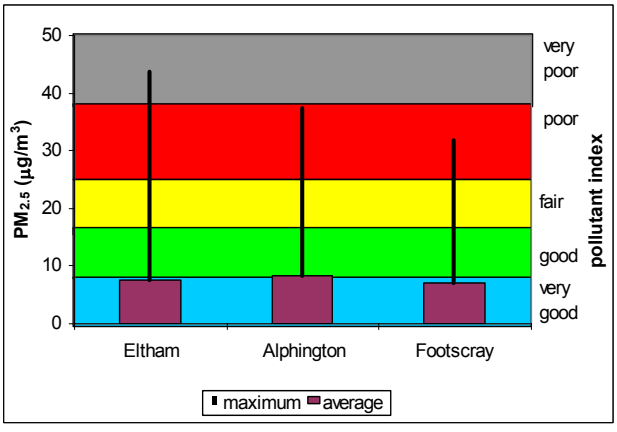

Figure 3: 24-hour $PM_{2.5}$ (national standard 25 µg/m³)

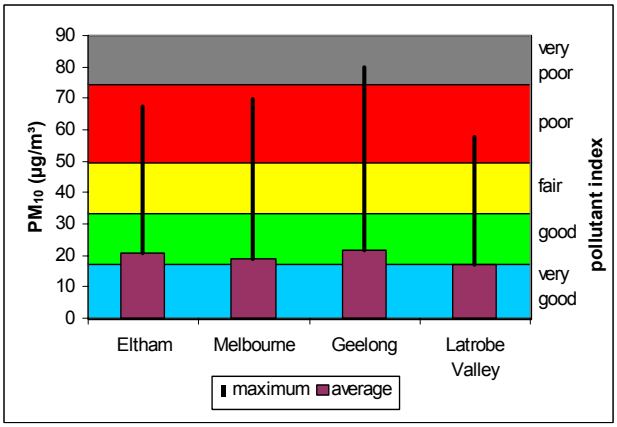

Figure 4: 24-hour PM_{10} (objective 50 µg/m³)

Benzo(α)pyrene met air quality standards

Benzo(α)pyrene is produced during combustion and the most likely source in Eltham is woodsmoke, with some contribution from motor vehicles. Figure 5 shows that the average benzo(α)pyrene level measured in Eltham was below the air quality objective and similar to other areas in Melbourne (Carlton, Alphington and Westgate Freeway) with similar combustion sources[5].

[5] Monitoring near Springvale Road was over spring and summer. During this time of year weather conditions are more likely to disperse pollutants such

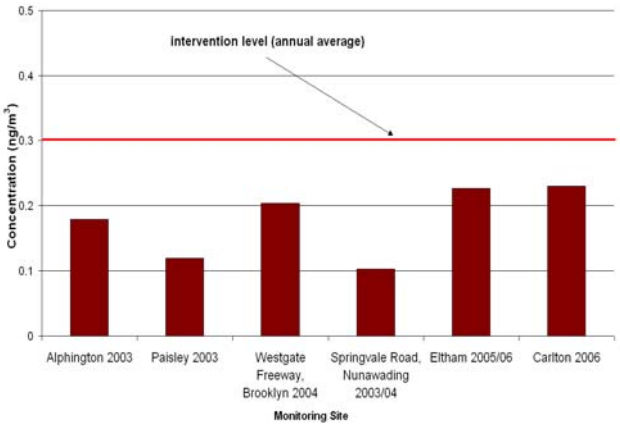

Figure 5: Average annual Benzo(α)pyrene

Gaseous pollutants met air quality standards

Figures 6 and 7 show that the maximum carbon monoxide and nitrogen dioxide levels at Eltham met air quality standards. Air quality for these pollutants was good to very good at all times.

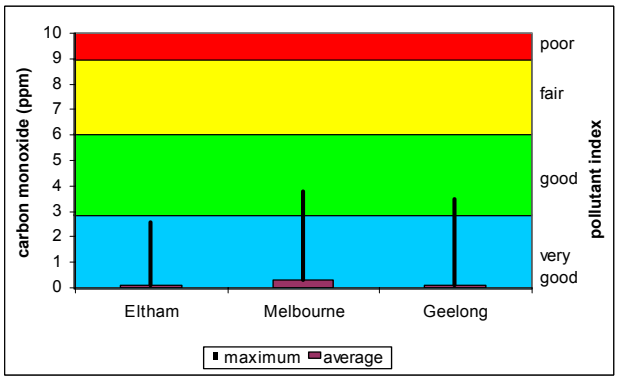

Figure 6: Eight-hour carbon monoxide (objective 9 ppm)

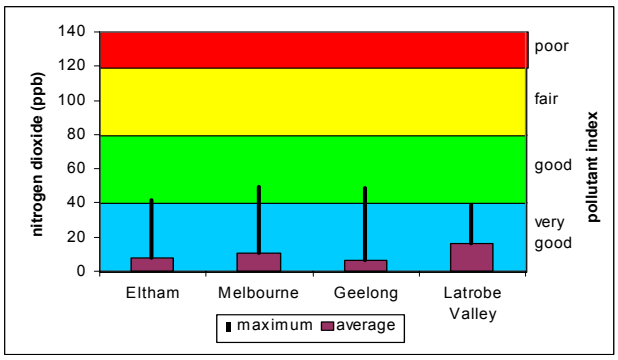

Figure 7: One-hour nitrogen dioxide (objective 120 ppb)

Figures 8 and 9 show that the maximum ozone levels at Eltham met the air quality objective except on one occasion. The four-hour average ozone levels went above the air quality standard on one day in February 2006. Although ozone levels met the air quality standard at all other monitoring sites on the same day, elevated levels were measured at other Melbourne sites during summer. This is typical of ozone, which can be formed from emissions some distance from the monitoring site. Ozone and the pollutants that lead to ozone are transported by wind around Melbourne.

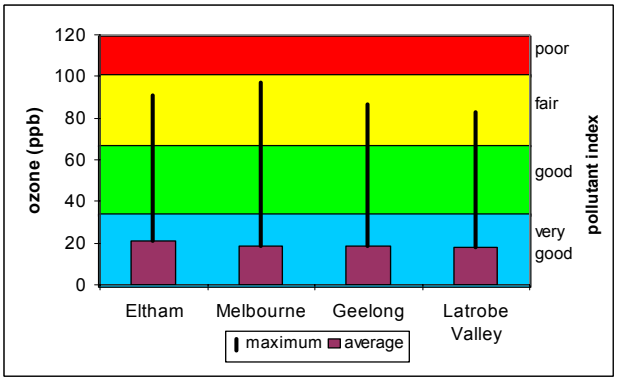

Figure 8: One-hour ozone (objective 100 ppb)

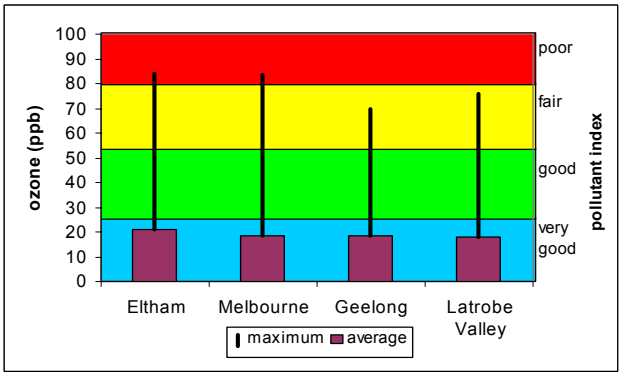

Figure 9: Four-hour ozone (objective 80 ppb)

as benzo(α)pyrene, resulting in lower levels. It is expected that, if monitoring had included winter, levels would be higher.

Figures 10 to 12 show that benzene, toluene and xylene all met the air quality objectives.

Figure 13 shows that formaldehyde met the objective in Eltham. There were two days when formaldehyde levels were higher, although they remained below the objective. The reason for the two reported formaldehyde levels on these two days is unknown.

Eltham's gaseous pollutant levels were similar to or lower than other regions

The maximum and average carbon monoxide levels in Eltham were lower than levels in other areas of Melbourne, and similar to levels in Geelong (Figure 6).

The maximum and average nitrogen dioxide levels in Eltham were similar to or lower than levels in Melbourne, Geelong and Latrobe Valley (Figure 7).

Eltham's maximum ozone level was similar to peak levels in Melbourne and higher than Geelong or Latrobe Valley. The average ozone levels in the four regions were similar.

Eltham's benzene, toluene and xylene levels were similar to other residential areas in Melbourne and Geelong and lower than near busy roads and industry.

CONCLUSIONS

Twelve months of monitoring showed that Eltham's air quality was generally good, with 95 per cent of the monitored days meeting air quality objectives. Eltham's air quality was similar to or better than that experienced in other areas of Melbourne, Geelong and Latrobe Valley.

Eltham's air quality was impacted by fine particles ($PM_{2.5}$) on nine days during cold conditions in June 2005. Based on EPA's emission inventory and evidence of particles coming from a combustion source, the most likely cause of higher $PM_{2.5}$ levels was a build-up of motor vehicle emissions and woodsmoke from domestic heating.

The ozone objective was not met on one day.

Carbon monoxide, nitrogen dioxide, benzene, benzo(α)pyrene, formaldehyde, toluene and xylene all met the air quality objectives during the 12 months of monitoring.

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[6], including:

- guidance on the selection, purchase, installation and maintenance of wood heaters
- tips for efficient wood heater operation, including advice on firewood selection
- guidance on what to do if your neighbours have excessively smoky wood heaters.

ACKNOWLEDGEMENTS

EPA Victoria would like to acknowledge the assistance of Eltham East Primary School for allowing the location of the mobile air monitoring station in the school's playground.

[6] 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 www.sustainability.vic.gov.au/

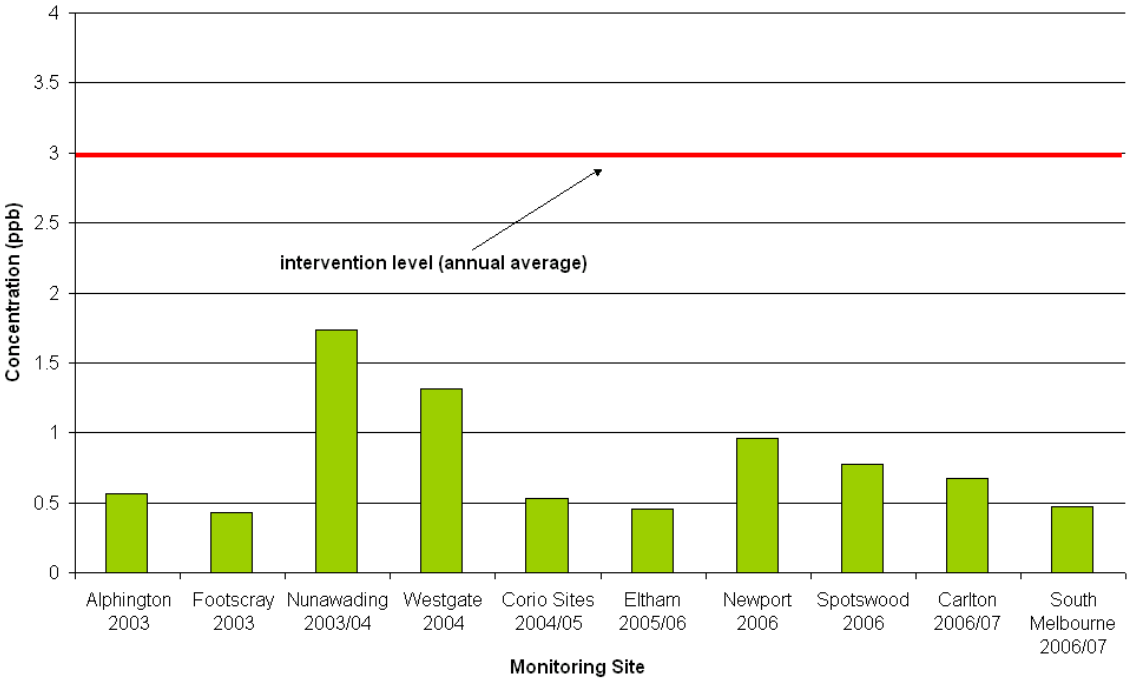

Figure 10: Average benzene concentration

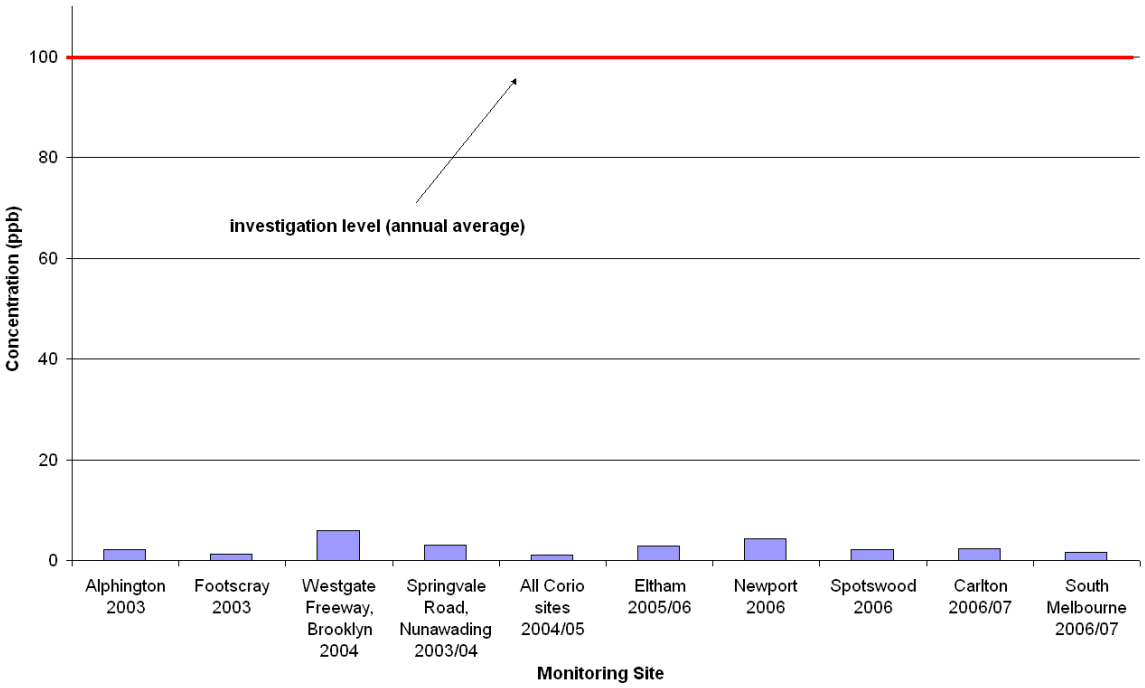

Figure 11: Average toluene concentration

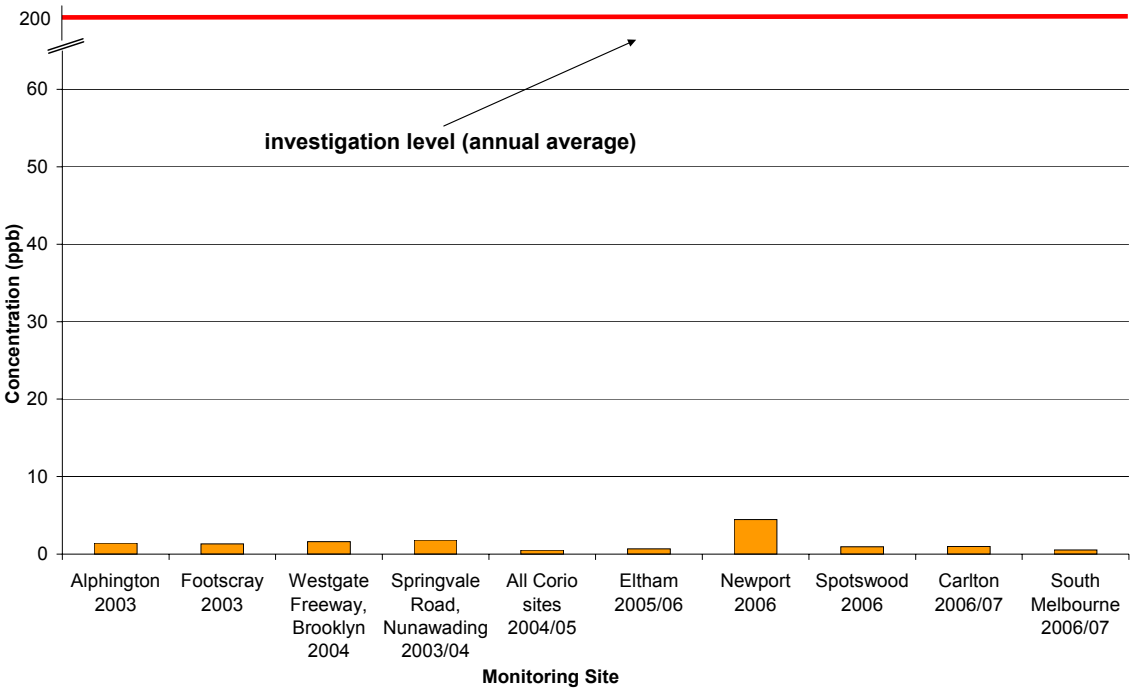

Figure 12: Average xylene concentration

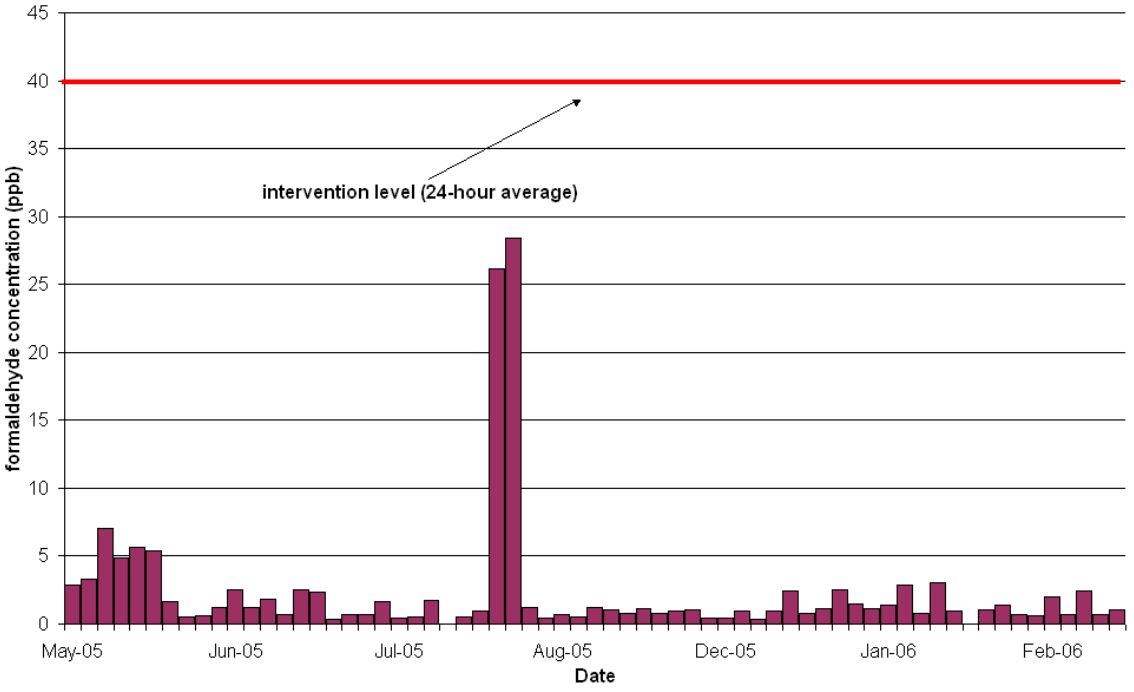

Figure 13: 24-hour formaldehyde concentration