carbon monoxide

INTRODUCTION

Carbon monoxide (CO) is a colourless flammable gas which is almost odourless and tasteless. It is produced by the incomplete combustion of carbonaceous substances such as wood, coal and oil.

Natural sources, such as oxidation of methane gas from decaying vegetation and from human respiration, are insignificant in urban areas.

Carbon monoxide is one of the most common, widely distributed air pollutants and urban levels vary depending on weather conditions and traffic density. Total emissions account for approximately half of all anthropogenic air pollutants by mass.

HEALTH EFFECTS

The toxicity of carbon monoxide is due mainly to haemoglobin having a far greater affinity for CO than for oxygen. This may lead to hypoxia and hence reduced cardiovascular and neural function.

Individuals most at risk include those with existing cardiovascular or chronic respiratory problems as well as the elderly and young children. Relatively low concentrations will aggravate symptoms in angina patients. Carbon monoxide may induce exhaustion and impair vigilance.

Symptoms of carbon monoxide poisoning escalate with exposure and range from headache and vomiting to, in severe cases, collapse and death. Smokers have elevated levels and would be susceptible to lower ambient concentrations.

OTHER EFFECTS

Carbon monoxide at present ambient levels has little effect on property, vegetation or materials. Plants both produce and metabolise CO and are usually only harmed by prolonged exposure to very high levels.

However, when further oxidation occurs in ambient air carbon dioxide (CO_2) is formed. Although CO_2 is the least potent it is the most important greenhouse gas because of its high emission rate.

SOURCES

Carbon monoxide is a product of combustion in oxygen of all carbonaceous compounds. With an adequate oxygen supply most CO produced is immediately oxidised to CO_2. However, CO can be formed whenever carbon compounds are burnt with an inadequate air supply. Such conditions exist in spark ignition combustion engines particularly during idling and deceleration.

In urban areas the main contributor (90%) of carbon monoxide is road transport and in particular petrol driven vehicles. CO is also produced in some industrial processes, heating plant and waste incineration.

Carbon monoxide was a major and hazardous constituent of Town gas.

Cigarette smoke contains concentrations of carbon monoxide up to 5% and in smokers, although the duration of exposure is limited, represents their main source of carbon monoxide.

Levels within vehicles are invariably higher than ambient levels.

Figure 6.1 Vehicles are the major source of carbon monoxide in Southwark.

STANDARDS

There are no UK or EU air quality standards for CO but WHO guideline values exist as shown in table 6.1.

Table 6.1 WHO carbon monoxide guidelines

8-hour mean	10mg/m^3
1-hour mean	30mg/m^3
30-minute mean	60mg/m^3
15-minute mean	100mg/m^3

MONITORING SITES

Carbon monoxide has been monitored at the locations shown in figure 6.2.

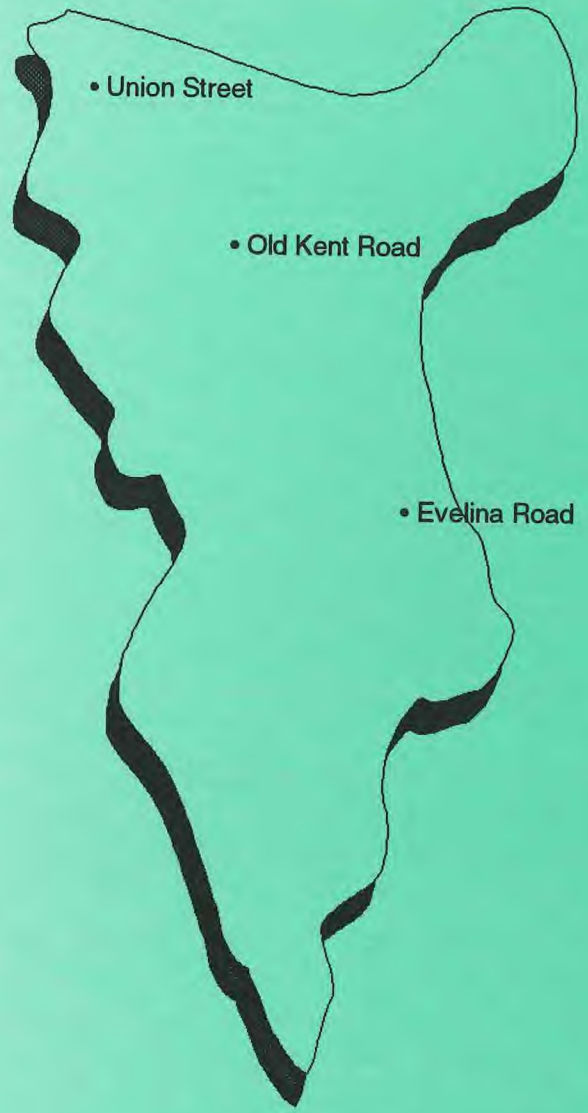

Figure 6.2 Carbon monoxide monitoring sites

carbon monoxide

carbon monoxide

LEVELS AND TRENDS

The following graphs show the mean concentrations of carbon monoxide at the sites indicated in figure 6.2.

Note: all graphs in this chapter have the same scale vertical axis and are therefore directly comparable.

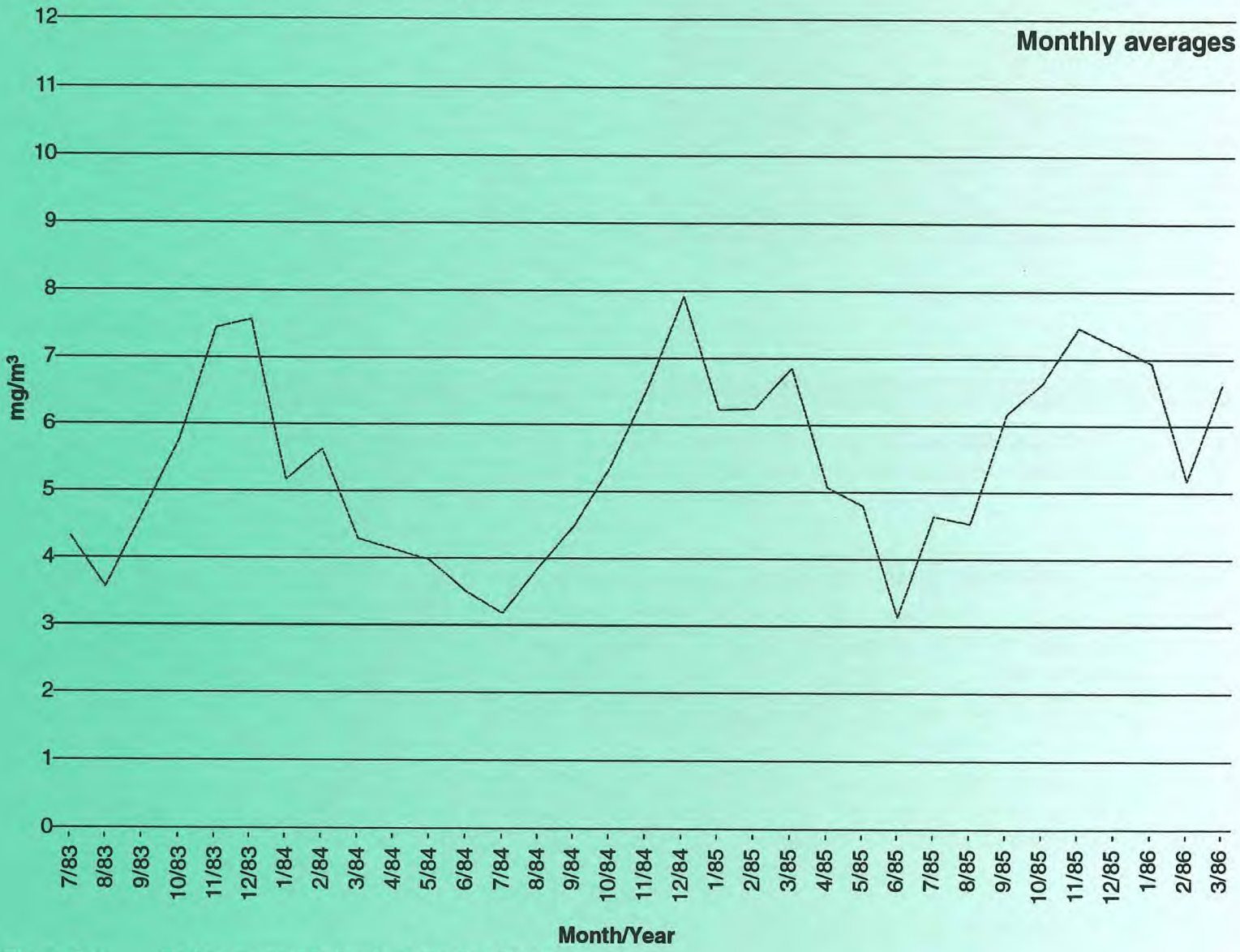

Figure 6.3 Carbon monoxide levels at Evelina Road July 1983 to March 1986

carbon monoxide

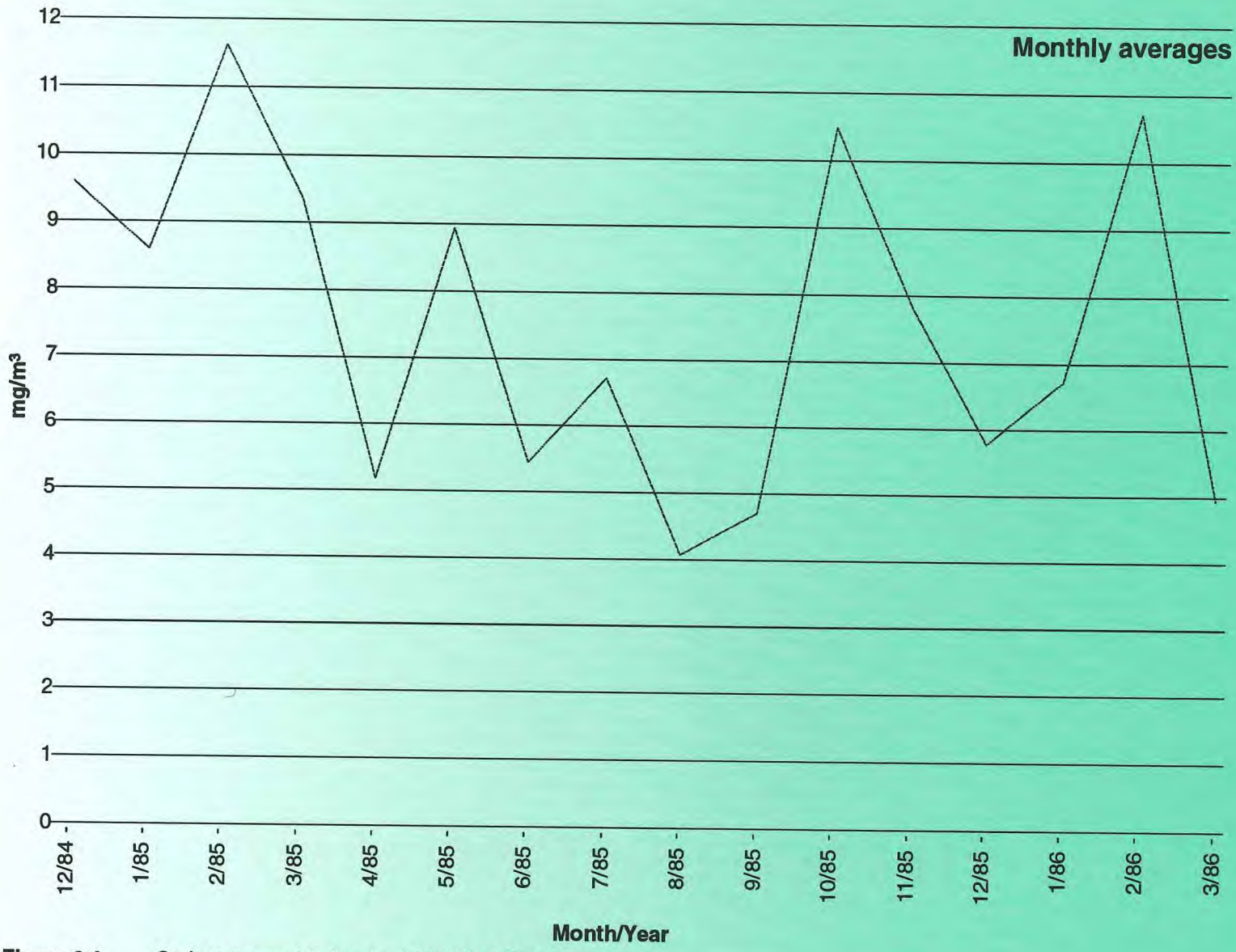

Figure 6.4 Carbon monoxide levels at Old Kent Road December 1984 to March 1986

carbon monoxide

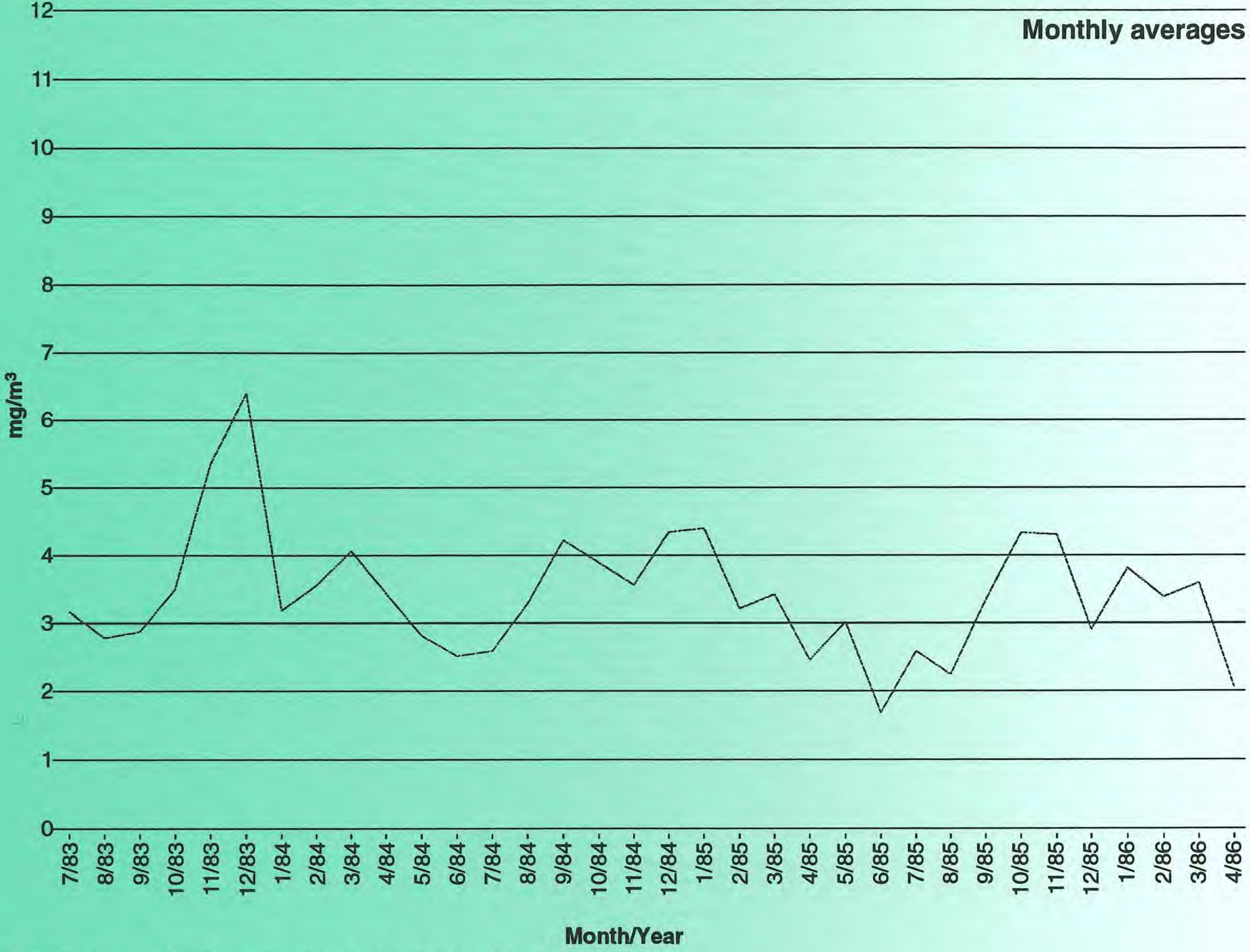

Figure 6.5 Carbon monoxide levels at Union Street July 1983 to April 1986

COMMENTARY

Discernible in all the graphs but clearly indicated in the graph for Evelina Road (Figure 6.3) is an annual cycle. The peaks occur in November/December with troughs in June/July. This indicates a correlation between recorded levels and weather conditions. Winter weather conditions are generally such that the dispersion of pollutants is less effective with local ground level entrapment a common feature.

A further feature is more obvious when the graphs are overlaid as shown in figure 6.6.

The Old Kent Road displays considerable monthly variation but Union Street displays more consistent levels and Evelina Road lies between the two. This characteristic also appears when considering daily averages and arises as a result of the 'canyon' effect. The Old Kent Road is much wider than Union Street with a mix of low and medium rise buildings and open space. Union Street however is very narrow with consistently tall buildings either side. This leads to entrapment at street level in the artificial canyon. Fortunately levels are much lower in Union Street since it carries much less traffic than the Old Kent Road.

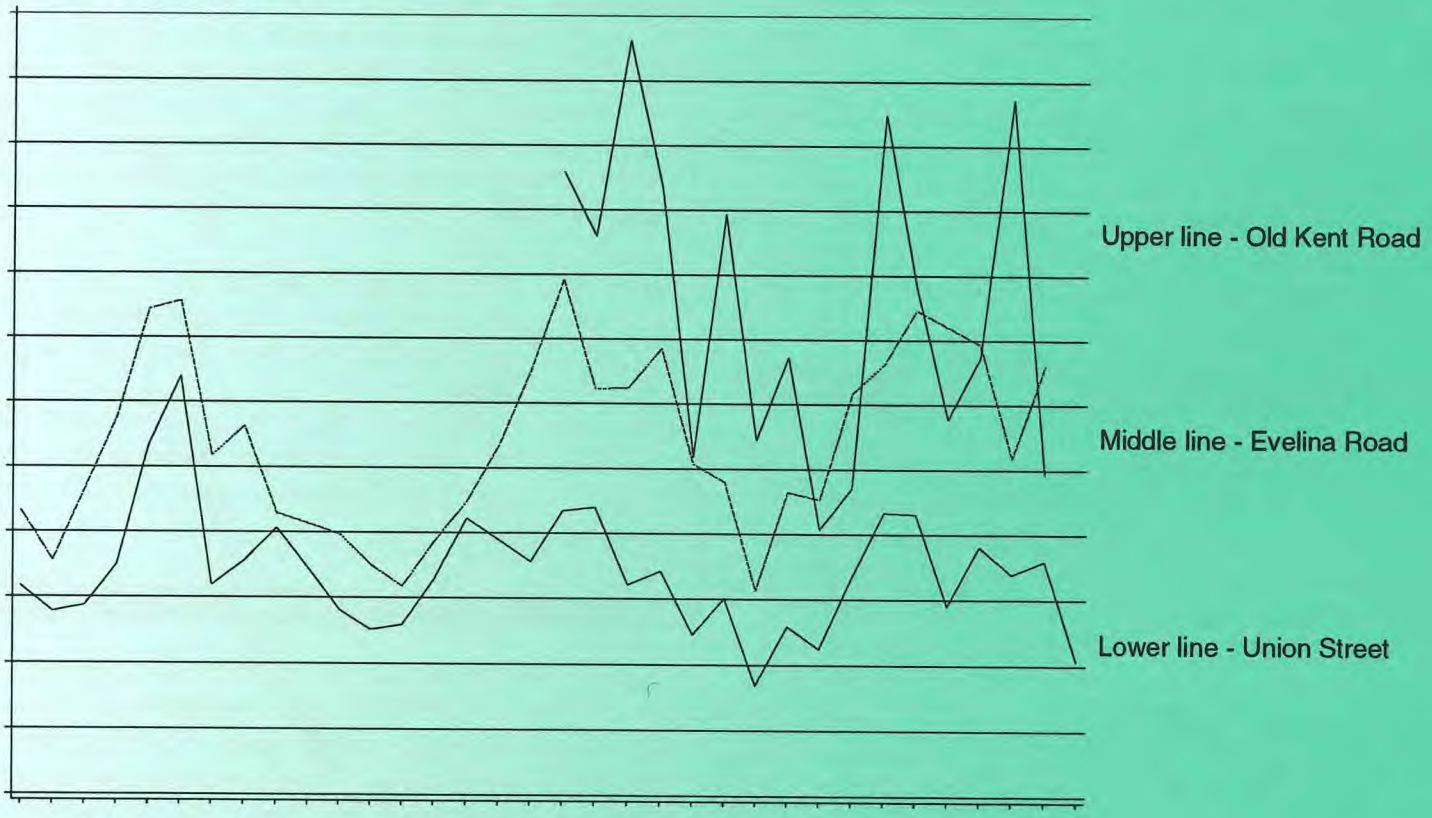

Figure 6.6 Comparison of carbon monoxide levels at the three monitoring sites.

carbon monoxide