particulates

INTRODUCTION

Particulates is a generic term applied to airborne matter of organic and inorganic origin, including both liquids and solids. In pollution terms it is normal to subdivide particulates based on their aerodynamic size. Coarse particles, greater than 2.5 microns (μm) in diameter, usually contains earth crustal material and fugitive dust from roads and industry. Fine particles, less than 2.5 microns in diameter, contain aerosols, combustion particles and recondensed organic and metallic vapours. The acid component of particulate matter generally occurs as fine particles.

Particulates may also be classified as primary or secondary in origin. Primary particulates are emitted directly to atmosphere while secondary particulates are formed by reactions in the atmosphere. In the urban environment most of the secondary particulates occur as a result of reactions involving NO_X.

A further category of significance derives from the degree of respirability and physiological effects and is known as PM_{10} (particulate matter with an aerodynamic diameter of 10 microns). An indication of particle size and respirability is given in table 8.1

Table 8.1 Particulate size and respiratory deposition

	Approximate particle size upper limit (μm)	lower limit (μm)
Upper respiratory tract (mainly nasal cavity)	100	15
Conducting airways (bronchioles)	15	2.5
Gas exchange area (alveoli)	2.5	-

HEALTH EFFECTS

The health effects of particulates depend on their size - smaller particles penetrate deeper into the respiratory system where the lungs are less effective in subsequently removing them. This may lead to absorption into the blood stream of surface contaminants or cause diseases such as emphysema or pneumoconiosis. The synergistic nature of particulates with other pollutants can also give rise to deficiency in pulmonary function, increased morbidity and increased mortality.

OTHER EFFECTS

Deposition of particulate matter causes soiling of fabrics and buildings. Vehicle emissions have a disproportionate staining power, tending to be composed of carbon and adsorbed hydrocarbons from unburnt fuel and combustion products, compared to the light, mainly siliceous, non vehicular particulate.

Severe cases of airborne particulates can impair visibility as witnessed by a smoky bonfire.

Plants generally cope well with deposited matter, other than when combined with other pollutants, and some act as efficient filters through their leaves. It is for this reason that the London Plane is the most common tree found on Southwark's streets.

Particulates also contribute to acid deposition and have a potential for the modification of our climate.

SOURCES

Particulate matter is emitted from industrial processes, building and demolition sites, power plants, incinerators, domestic and industrial heating plant and motor vehicles.

There are now no significant emissions from industry in Southwark but there are a number of large domestic district heating systems of varying efficiency and cleanliness as well as a large number of smaller commercial plants and standby systems which usually burn oil and emit smoke falling within the particulate categories.

The most significant source is currently due to vehicle use with diesel vehicles being notable the main contributors.

Natural sources such as volcanoes, although obvious and dramatic, are less widespread and less important.

Figure 8.1 Bankside power station when operational was a significant stationary source of particulates

STANDARDS

The air quality standard for smoke is set by EU Directive 80/779/EEC (as amended by 89/427/EEC) which has been implemented in the UK by the Air Quality Standards Regulations 1989.

Limit Values are specified as shown in table 8.1. No Guide Values exist.

Numerous standards deriving from European Directives exist for the control of particulate emissions from vehicles. These are implemented in the UK by the Motor Vehicles (Construction and Use) Regulations and the Motor Vehicles (Type Approval) (Great Britain) Regulations made under the Road Traffic Act 1988.

Separate standards have been set for Light Duty Vehicles, Light Commercial Vehicles and Heavy Duty Vehicles. Of the two EU standards applicable in the period of this report the most significant and still current is that for Heavy Duty Vehicles. This applies to lorries and buses etc. over 3.5 tonnes and will be introduced in phases up to October 1996. The standard introduces strict mass limits for particulate emissions based on output energy as shown in table 8.2.

Note: The kilowatt hour (kWh) is a unit of energy similar to horsepower although different in value.

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Table 8.2 Air Quality Standards for smoke

EU Limit values

Year (median of daily values)	80μg/m^3
Winter (median of daily values)	130μg/m^3
Year (peak) (98th percentile of daily values)	250μg/m^3

Table 8.3 HD Vehicle emission limits for particulates

Step I (current phase)

Type approval (for engines ≤85kW a coefficient of 1.7 is applied)	0.36g/kWh

Step II (1996)

Type approval & conformity of production	0.15g/kWh

MONITORING SITES

The locations of sites monitored for particulate matter is shown in figure 8.2 below.

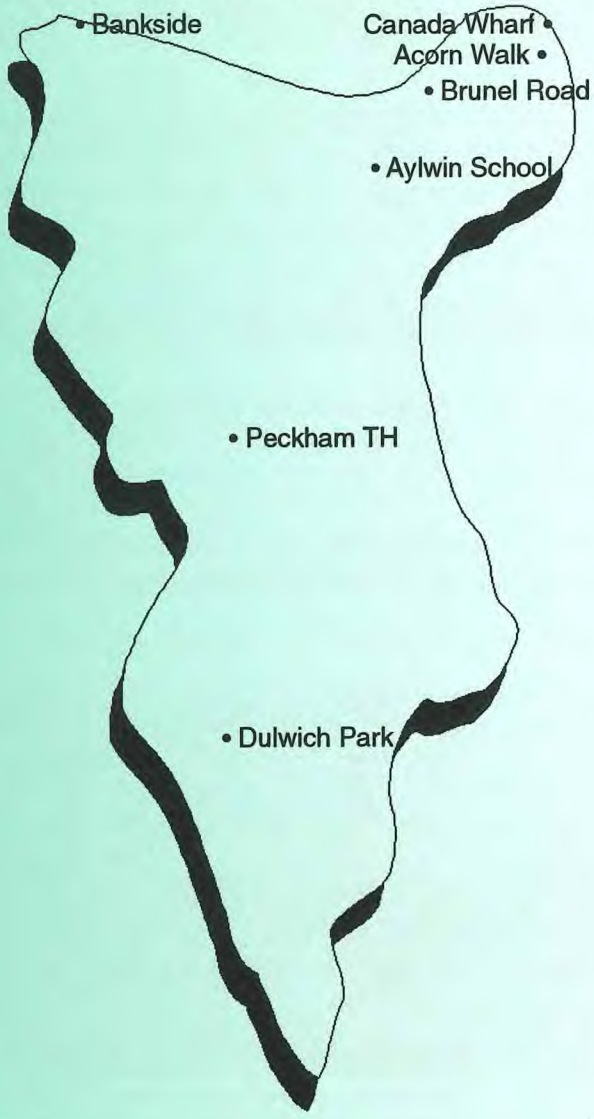


Figure 8.2 Particulate monitoring sites

COMMENTARY

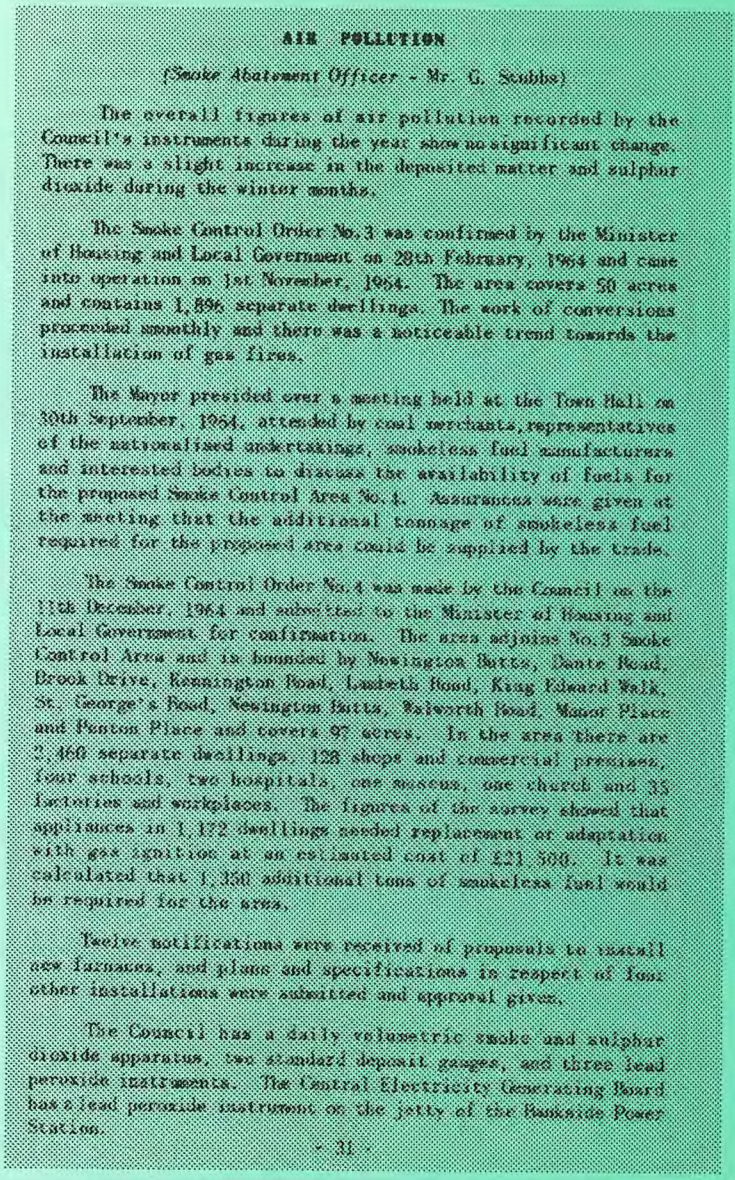
The graphs on the following pages record levels prior to the completion of Southwark's Smoke Control Orders and hence only a small net decrease in particulates deriving from domestic coal burning can be seen. For those graphs showing ash as well as total particulate matter it can be seen that the contribution from domestic fuel was significant and various peaks indicate particularly cold winters.

The reduction in particulate matter from domestic coal burning ocurred at the same time as vehicle use began to escalate and at some sites there is no discernable improvement. The consistently highest levels have been recorded at sites close to busy roads.

Apart from peak anomalies the highest monthly average in Southwark was approximately 240$\mu g/m^2$. For comparison, measured values of particulate matter during the smog of 1952 reached 1500$\mu g/m^2$.

In more recent times the contribution from widespread demolition and construction work, in particular in the north of the borough, has highlighted the potential for locally elevated levels and the continued need for control of such activities by Southwark Council's Environmental Health Service.

Since the introduction of authorisation of prescribed processes under the Environmental Protection Act 1990 there has been additional local authority control over industrial emissions.



AIR POLLUTION

(Smoke Abatement Officer - Mr. G. Scubbs)

The overall figures of air pollution recorded by the Council's instruments during the year show no significant change. There was a slight increase in the deposited matter and sulphur dioxide during the winter months.

The Smoke Control Order No.3 was confirmed by the Minister of Housing and Local Government on 28th February, 1964 and came into operation on 1st November, 1964. The area covers 50 acres and contains 1,896 separate dwellings. The work of conversions proceeded smoothly and there was a noticeable trend towards the installation of gas fires.

The Mayor presided over a meeting held at the Town Hall on 30th September, 1964, attended by coal merchants, representatives of the nationalised undertakings, smokeless fuel manufacturers and interested bodies to discuss the availability of fuels for the proposed Smoke Control Area No.4. Assurances were given at the meeting that the additional tonnage of smokeless fuel required for the proposed area could be supplied by the trade.

The Smoke Control Order No.4 was made by the Council on the 11th December, 1964 and submitted to the Minister of Housing and Local Government for confirmation. The area adjoins No.3 Smoke Control Area and is bounded by Newington Butts, Dante Road, Brook Drive, Kennington Road, Lambeth Road, King Edward Walk, St. George's Road, Newington Butts, Walworth Road, Manor Place and Penton Place and covers 97 acres. In the area there are 2,466 separate dwellings, 128 shops and commercial premises, four schools, two hospitals, one museum, one church and 35 factories and workplaces. The figures of the survey showed that appliances in 1,172 dwellings needed replacement or adaptation with gas ignition at an estimated cost of £21,500. It was calculated that 1,350 additional tons of smokeless fuel would be required for the area.

Twelve notifications were received of proposals to install new furnaces, and plans and specifications in respect of four other installations were submitted and approval given.

The Council has a daily volumetric smoke and sulphur dioxide apparatus, two standard deposit gauges, and three lead peroxide instruments. The Central Electricity Generating Board has a lead peroxide instrument on the jetty of the Bankside Power Station.

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Figure 8.3 The scope of Smoke Control Orders is indicated in this extract from the 1964 Annual Report of the Medical Officer of Health for the Metropolitan Borough of Southwark.

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LEVELS AND TRENDS

The following graphs show the levels of particulate matter at the sites shown in figure 8.2

Note: the graphs in this chapter do not have the same vertical scale and are not therefore directly comparable.

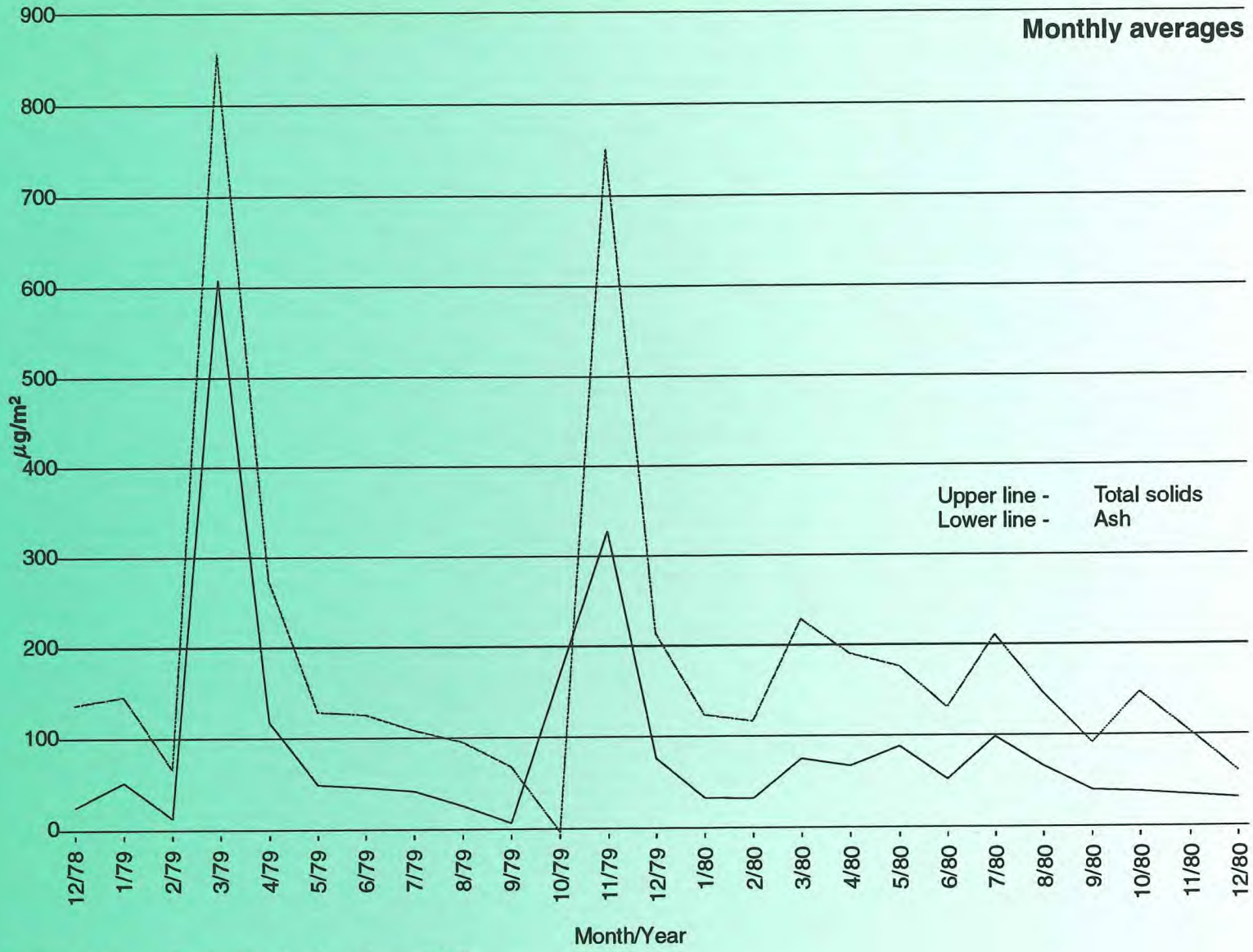

Figure 8.4 Particulate levels at Acorn Walk December 1978 to December 1980

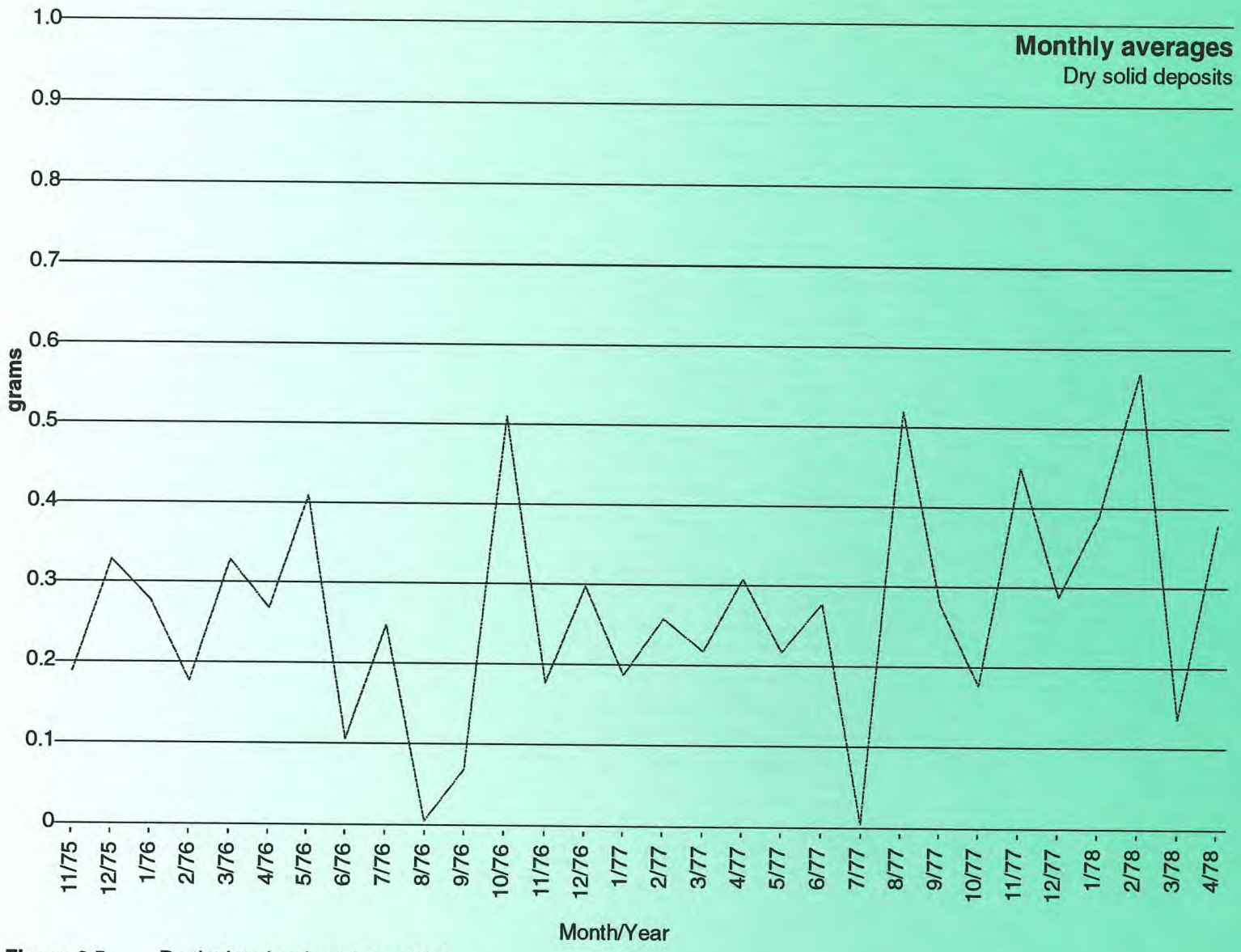

Figure 8.5 Particulate levels at Acorn Walk
November 1975 to April 1978

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Figure 8.6 Particulate levels at Aylwin School
November 1975 to April 1978

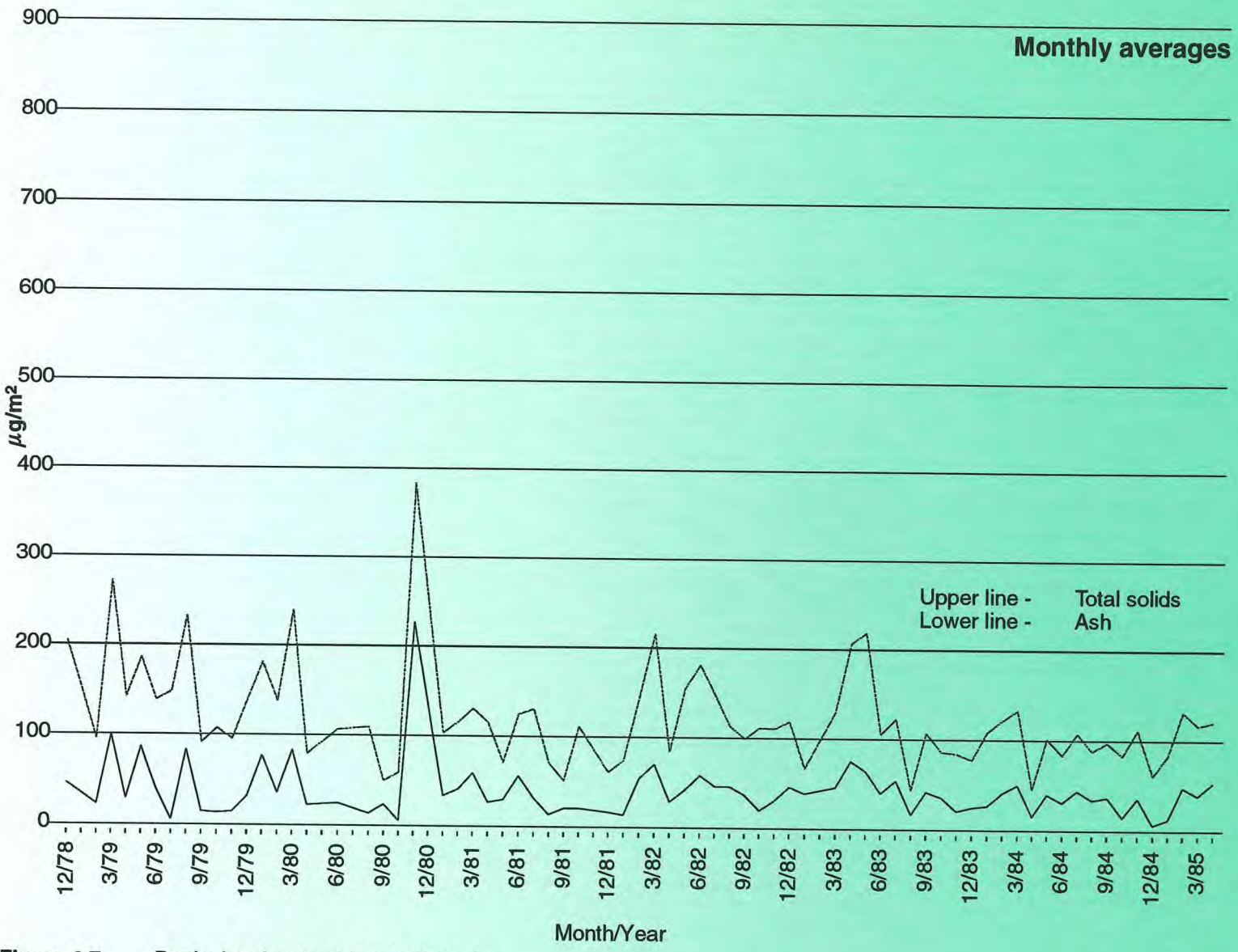

Figure 8.7 Particulate levels at Aylwin School December 1978 to April 1985

particulates

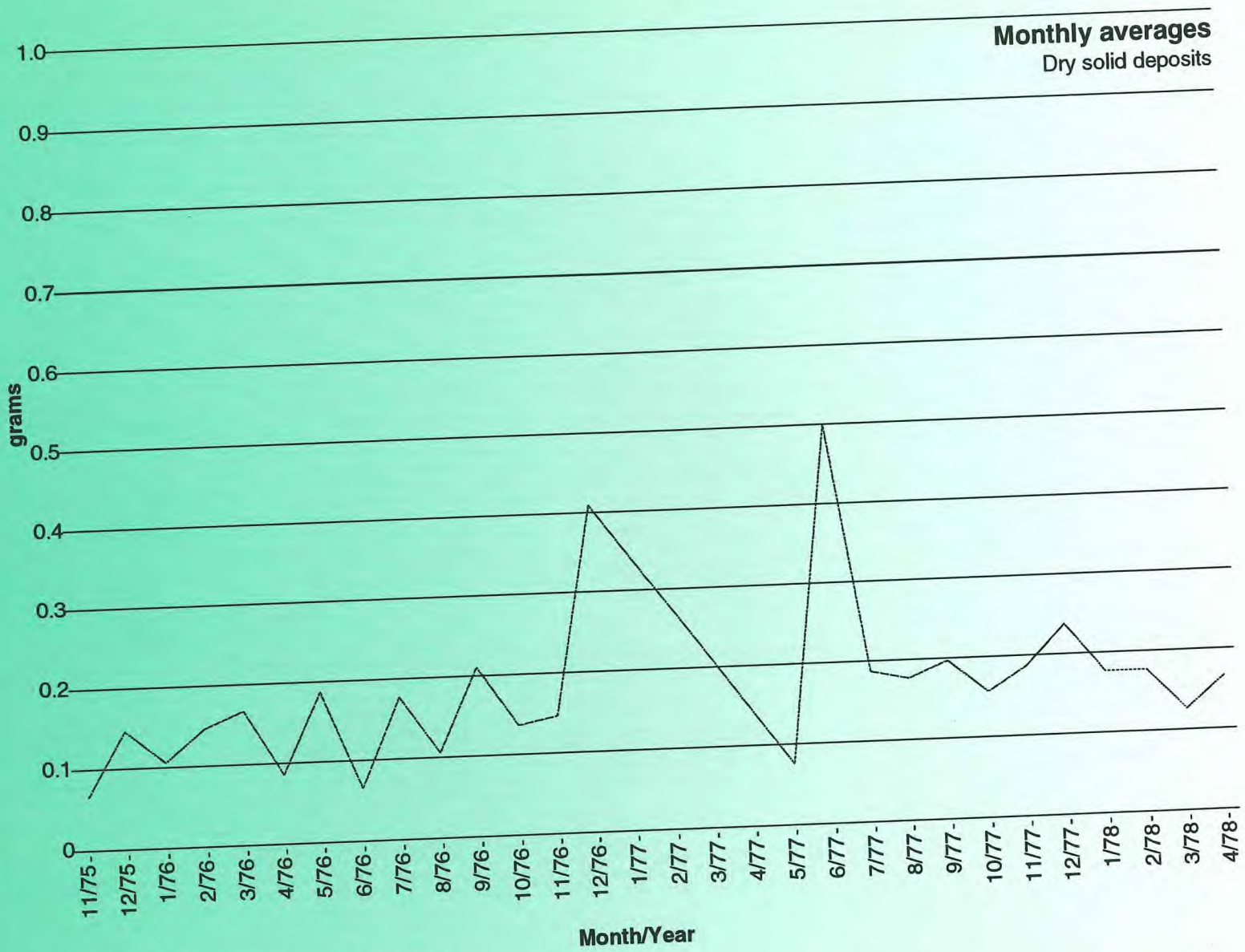

Figure 8.8 Particulate levels at Bankside
November 1975 to April 1978

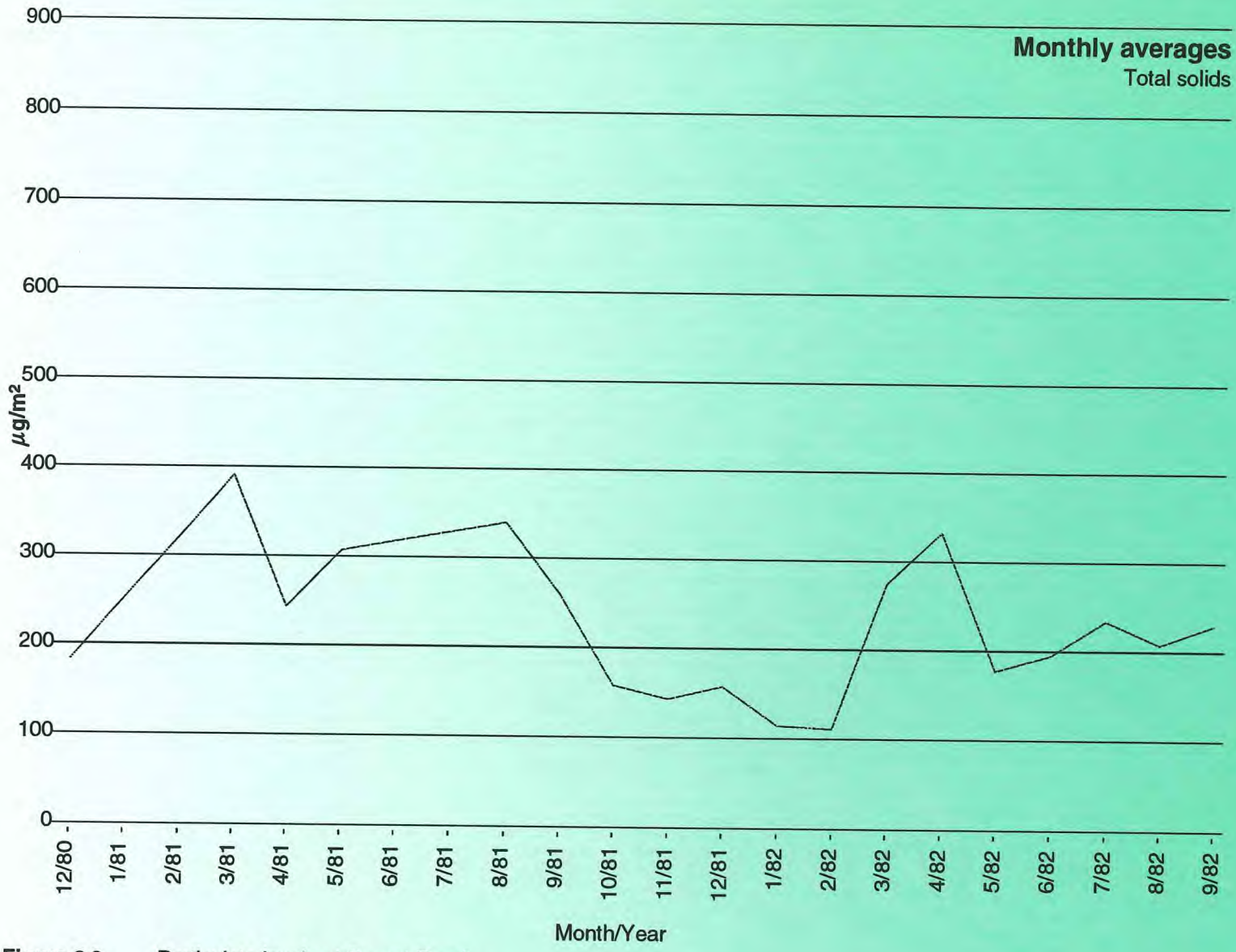

Figure 8.9 Particulate levels at Brunel Road
December 1980 to September 1982

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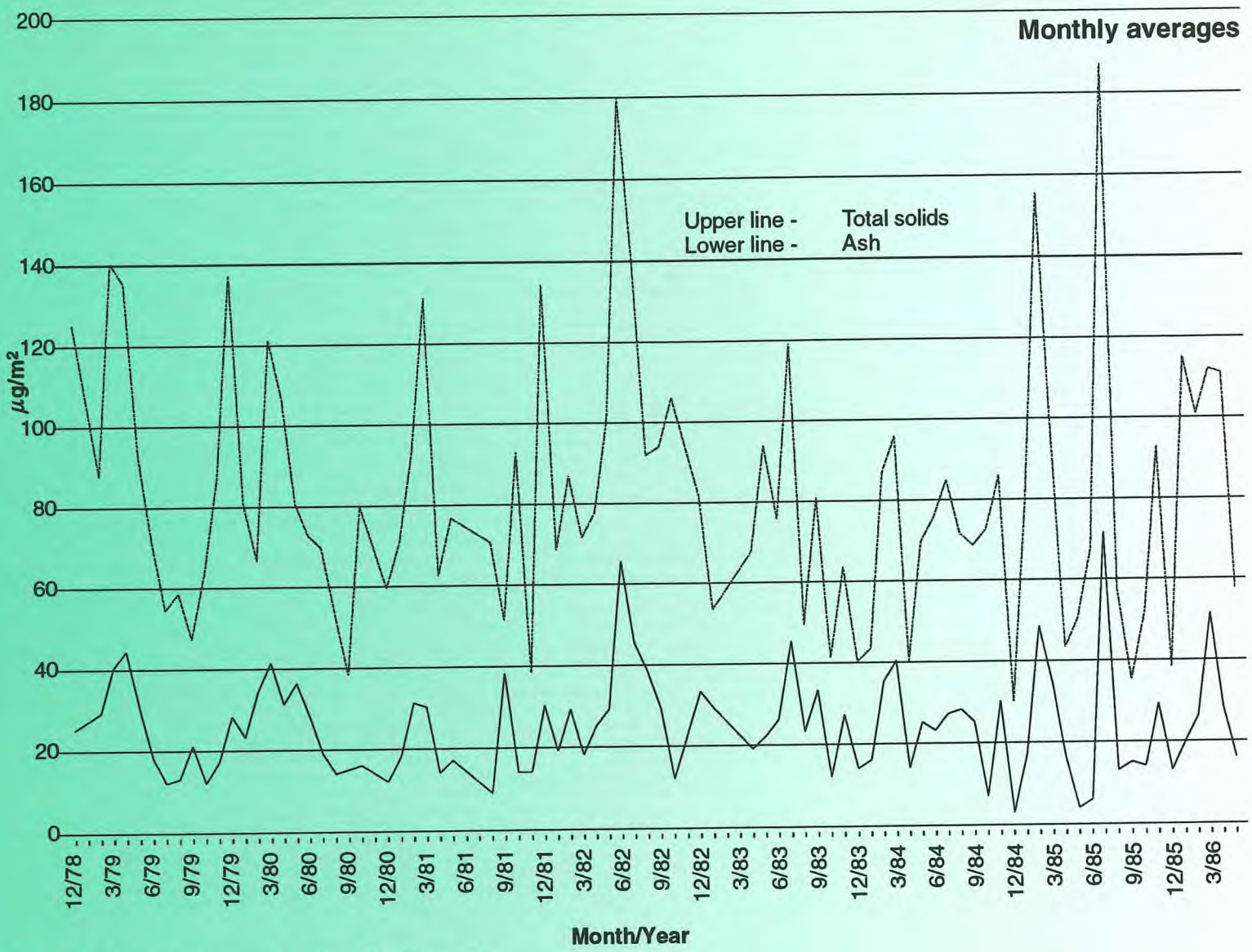

Figure 8.10 Particulate levels at Peckham TH December 1978 to May 1986

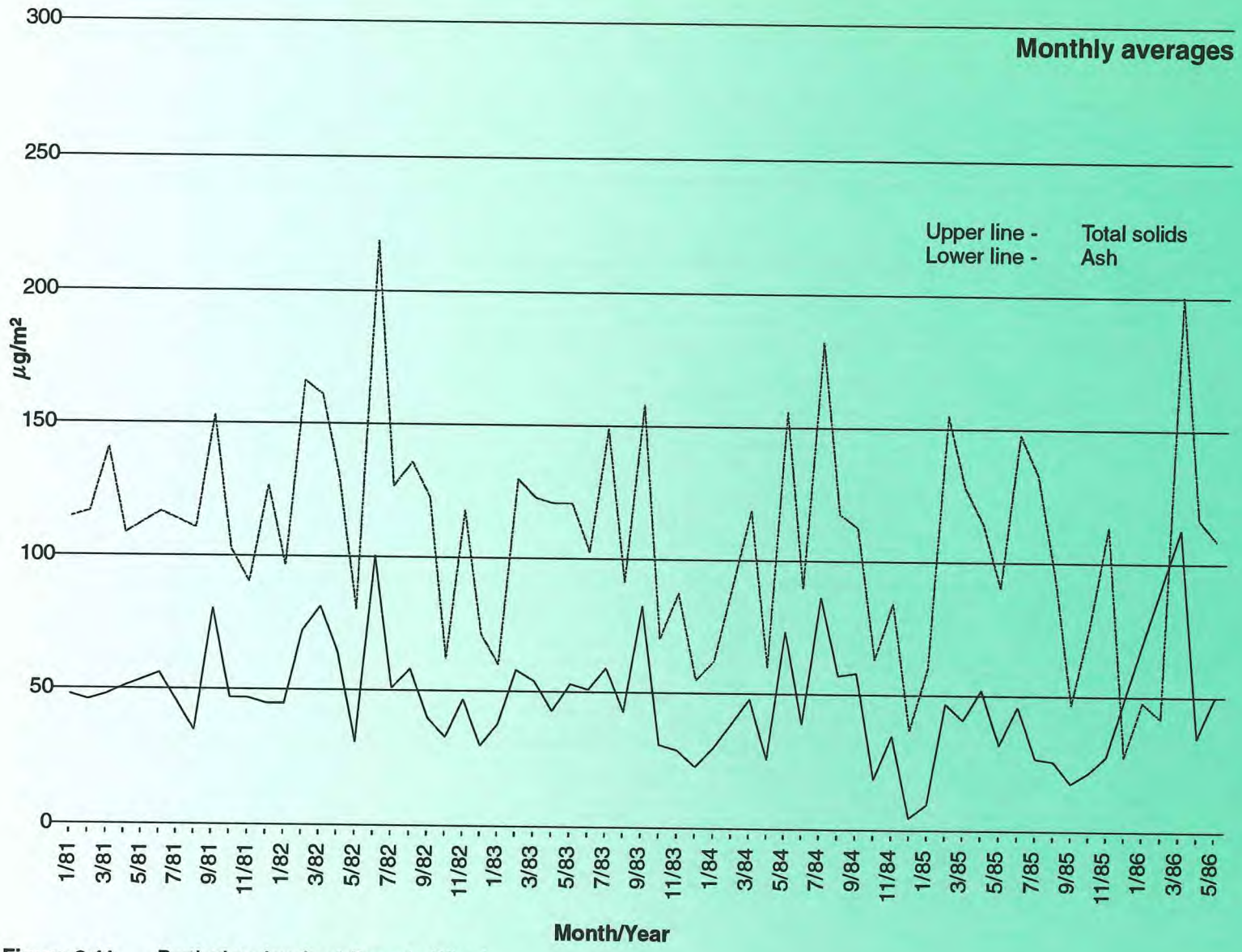

Figure 8.11 Particulate levels at Canada Wharf
January 1981 to May 1986

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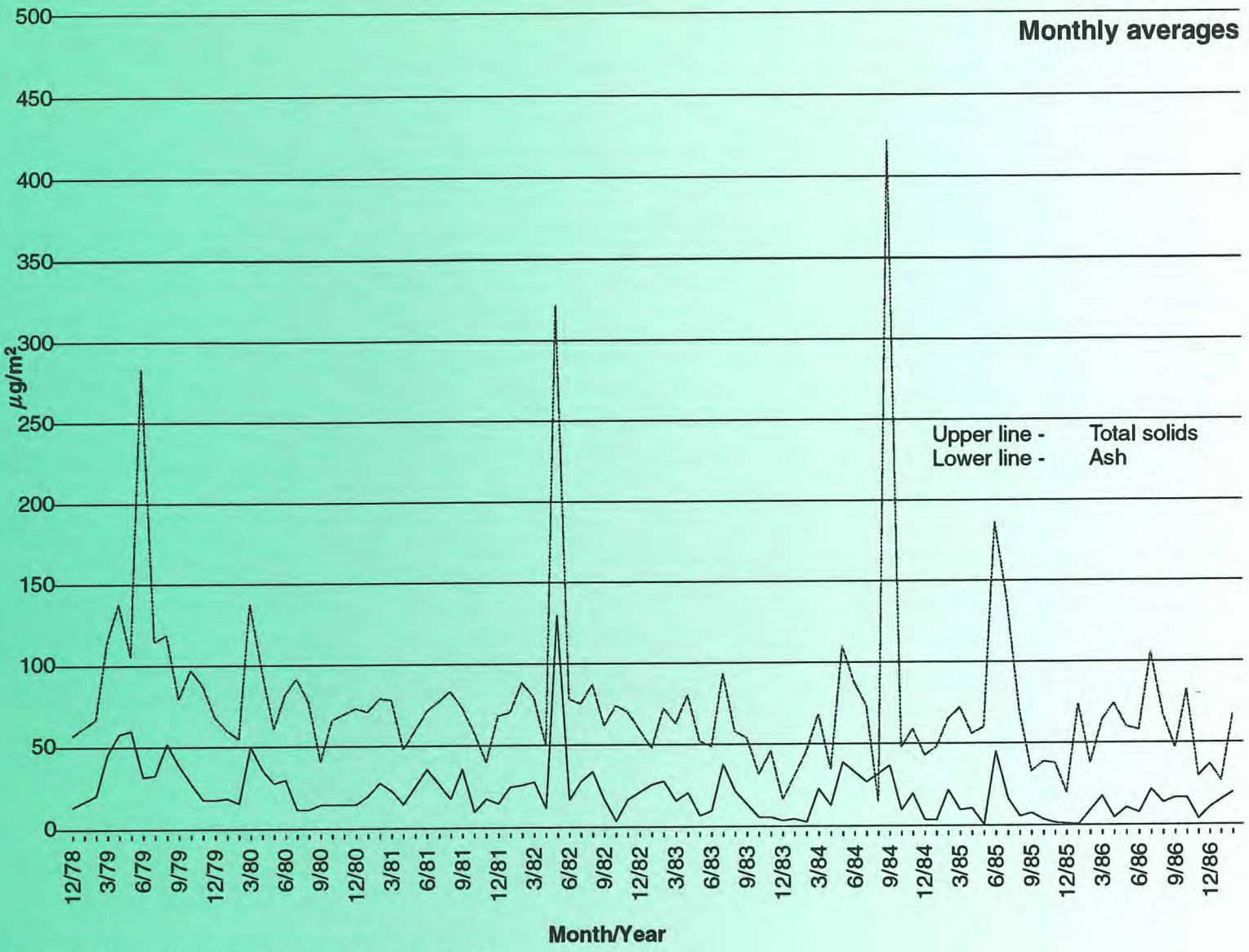

Figure 8.12 Particulate levels at Dulwich Park December 1978 to February 1987

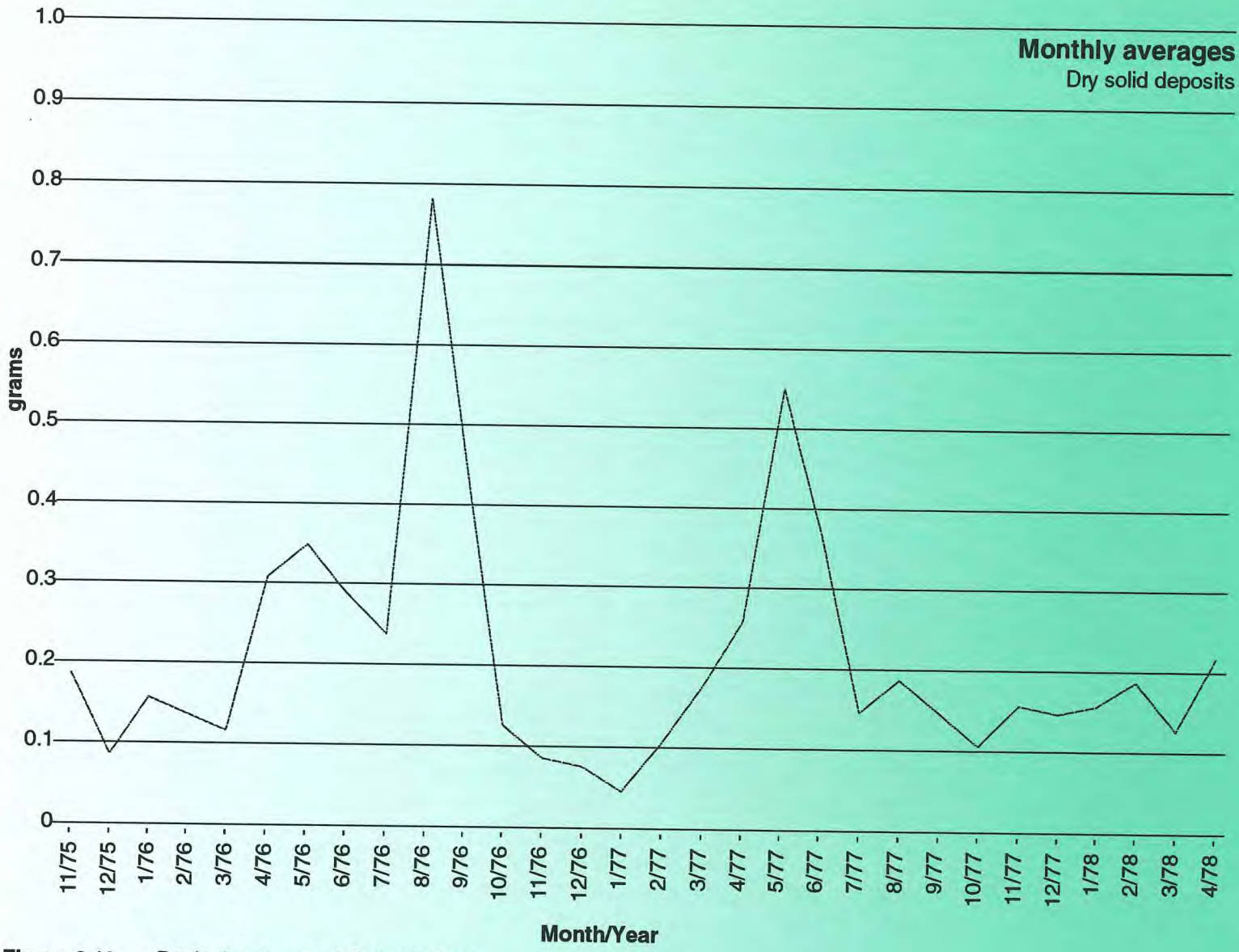

Figure 8.13 Particulate levels at Dulwich Park November 1975 to April 1978