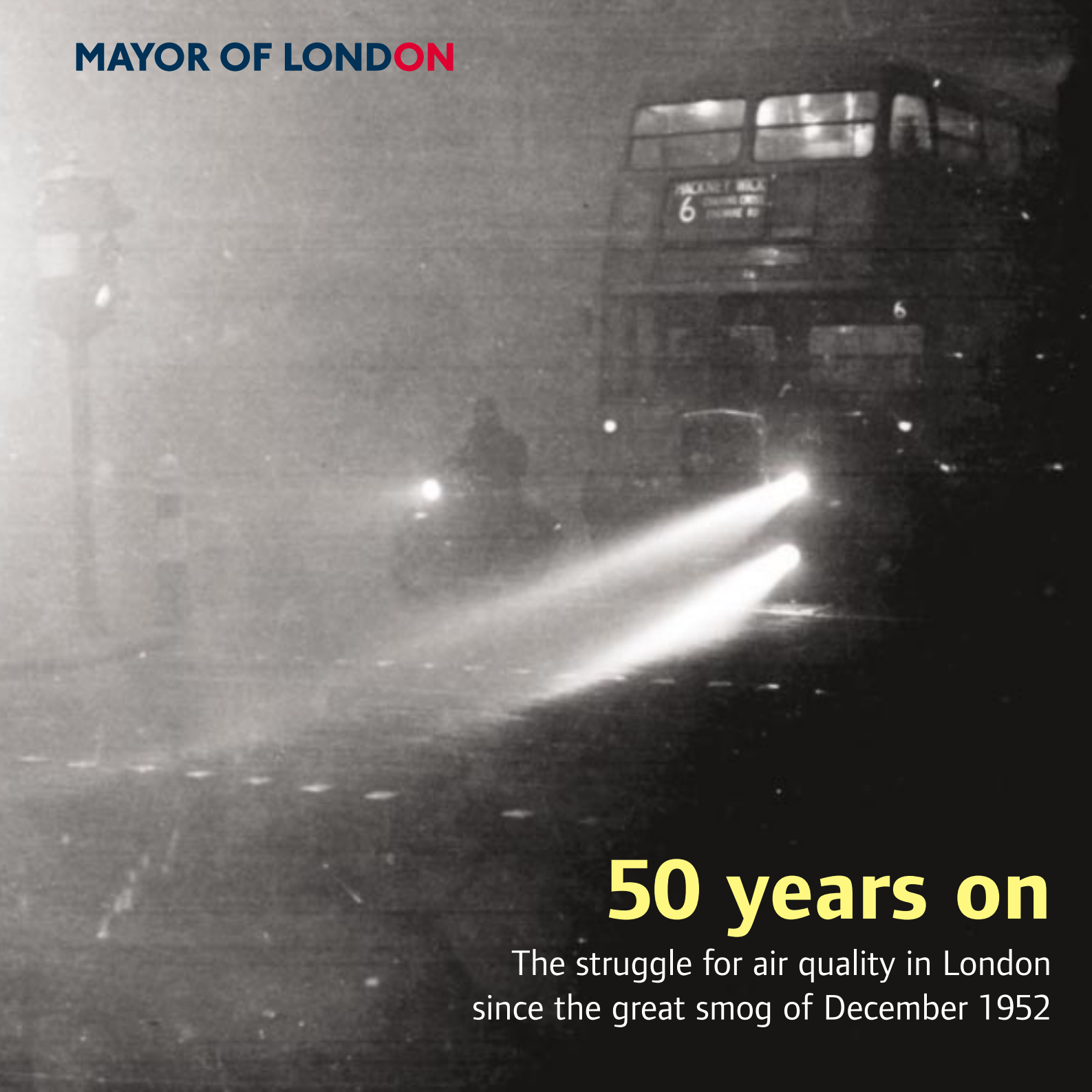
MAYOR OF LONDON



# 50 years on

## The struggle for air quality in London since the great smog of December 1952

# copyright

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**December 2002**

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# contents

*A couple wearing smog masks take an afternoon stroll along The Embankment*

# the Mayor of London's recollection of London smog

*Ken Livingstone*
*Mayor of London*

Anyone who was living in London at the time will remember the great smog of December 1952.

For those like me who were children at the time, it's main impact was that we didn't have to go to school for a few days. The fog was simply so thick that parents were advised not to risk letting their children get lost on the way to school, unless it was literally round the corner. When my parents went out they had to cover their nose and mouth with a handkerchief.

For many other Londoners, particularly the elderly, the effects of the 1952 smog were far more severe. Up to 4,000 people are estimated to have died prematurely.

The cause was a mixture of industrial pollution and domestic coal burning. Back then virtually no-one had central heating, relying instead on coal fires.

In response to the 1952 smog, the Government passed legislation to phase out coal fires, which meant initially many people transferred to paraffin heaters, until central heating became more widespread.

There was a good deal of discontent and people were resistant to change. I have to say that I was quite pleased because it was my job to go out and clean the fire out in the morning — raking out all the bits of unburned coal to save them for the next fire.

Looking back 50 years I can't imagine there are many people now who don't recognise that this was the right policy.

Similarly today, as we try to tackle new forms of pollution caused primarily by motor vehicles, some people are reluctant to accept the necessity of cleaning up engines and fuels.

My view is that while children are still suffering from pollution-aggravated asthma, and elderly people are dying prematurely simply because of the air that they are forced to breathe, it is our duty to take the difficult decisions that governments in the 1950s were forced to take to deal with the smogs.

I hope this booklet helps to educates some and remind others of the consequences of failing to deal with air pollution half a century ago and helps move on the debate about how we improve air quality today.

**Ken Livingstone**
Mayor of London

# the great smog of December 1952

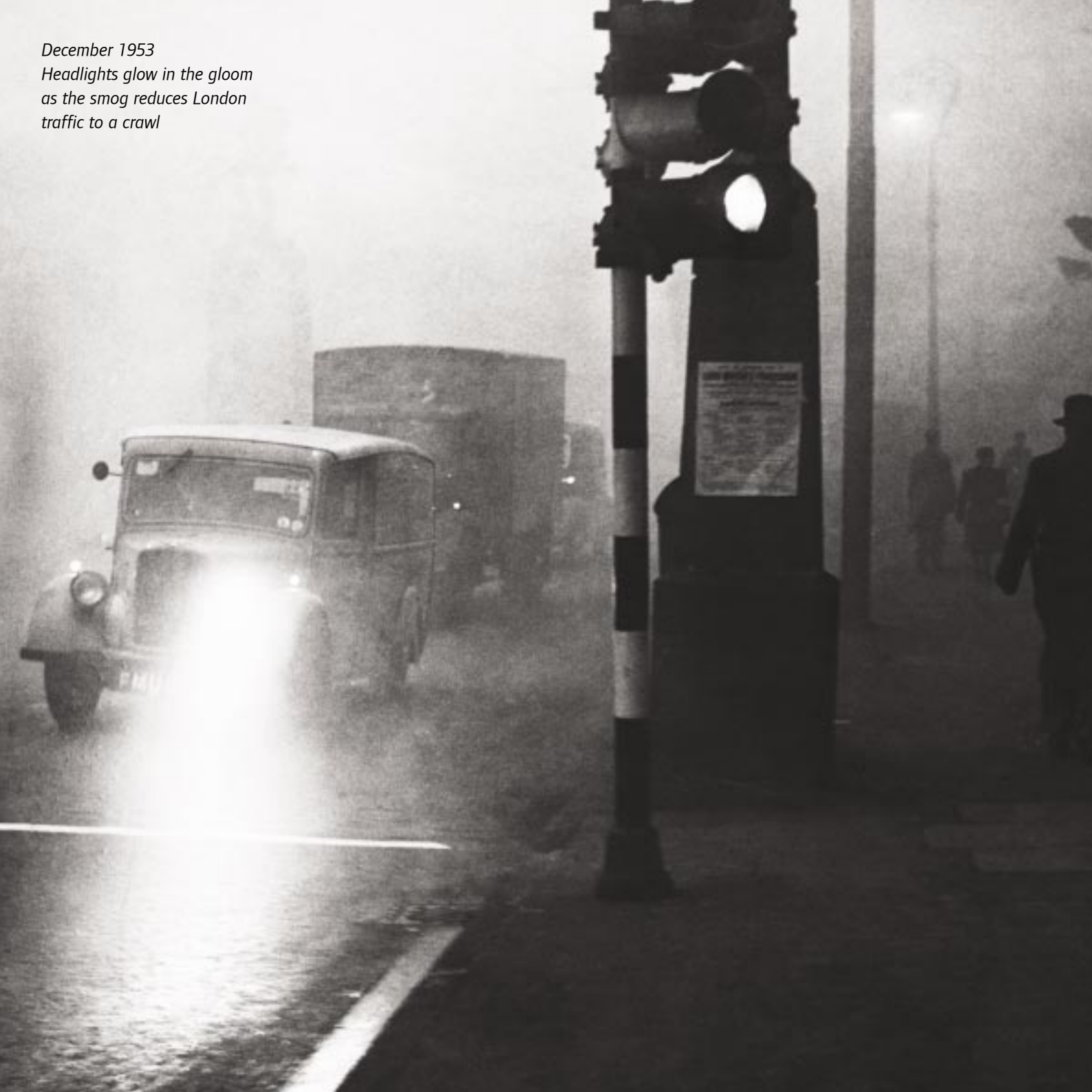
This account of the London fog, or smog[1], of December 1952 is based on several assessments prepared in the aftermath including a report prepared by a Ministry of Health committee of officials and experts[2].

A dense fog covered Greater London between the 5 and 8 December 1952, accompanied by a sudden rise in mortality that far exceeded anything previously recorded during similar periods of smog. The Ministry of Health's committee later estimated that between 3,500 and 4,000 more people had died than would have been expected under normal conditions. The deadly smog was notable both for its density and its duration. 'In a city traditionally notorious for its fogs there was general agreement on its exceptional severity on this occasion.' However the death toll only became apparent after the event.

The first reported casualties of the smog were cattle at the Smithfield Show. An Aberdeen Angus died, twelve other cattle had to be slaughtered, sixty needed major veterinary treatment, and about a hundred more needed minor attention. All were relatively young and in prime condition.

At Sadler's Wells, the opera *La Traviata* had to be abandoned after the first act because the theatre was so full of smog. A number of stories on the smog appeared in the newspapers, with *The Times* covering the high economic cost of the smog.

However, it was the coroners, pathologists and the Registrars of Deaths who first became aware of the exceptional effects on the people of London. The number of deaths attributable to the smog was similar to



*December 1953*
*Headlights glow in the gloom as the smog reduces London traffic to a crawl*

the numbers caused by the cholera epidemic of 1854 and the influenza epidemic of 1918.

The weather conditions at the time of the 1952 smog[3] were typical of those that still give rise to poor air quality in London. The only unusual feature was that it persisted for so long. An anticyclone (an area of high pressure) was centred over southern England and there was an almost complete absence of wind. Temperatures remained at or slightly below freezing in central London.

In the Thames Valley, the absence of wind produced a temperature inversion, with a layer of warm air overlying the cold air at ground level. These conditions allowed the smog to become widespread. The temperature inversion prevented the smog from dispersing and trapped in the smoke and other air pollutants, particularly in central London. On the outskirts of London the smog was patchy, particularly at midday, but in central London there was no letup.

Sunday 7 December was probably the worst day, and there were few areas of Greater London that were not blanketed with a dense smog. On 8 December, a light wind cleared some areas, including Westminster but not the East End, Kent or Essex[4], but the smog returned that night. On 9 December, however, a southwesterly wind finally cleared the smog from all areas.

During the smog, both smoke and sulphur dioxide levels reached exceptional concentrations. The previous December, the mean smoke concentration across twelve sites for which data was available was between 0.12 and 0.44 milligrammes per cubic metre ($mg/m^3$). In 1952, the wind speed dropped on the afternoon of Thursday 4 December and patches of fog had begun to appear by 6pm. Air pollution measurements were taken by the London County Council at its headquarters, County

Hall in Lambeth, later to be the offices of the Greater London Council.

By noon the next day, smoke concentrations at County Hall had risen from 0.49 mg/$m^3$ to 2.46 mg/$m^3$. They continued to rise to 4.46 mg/$m^3$ on both 7 and 8 December. Sulphur dioxide ($SO_2$) followed a similar pattern with concentrations rising from 0.41 mg/m3 on 4 December to 2.15 mg/$m^3$ on the 5th and to 3.83 mg/$m^3$ on both the 7 and 8 December. The concentrations of both smoke and $SO_2$ dropped sharply to 1.22 mg/$m^3$ and 1.35 mg/$m^3$ respectively as wind speeds rose and the smog cleared on Tuesday 9 December.

This rise and fall is illustrated in Figure 1, which also shows the average concentrations in December 1951. The peak concentration was the highest recorded at County Hall since measurements began in 1932. An indication of the generally high smoke concentration is given by comparing December 1951 with the average concentration in December 2001, which was just 2.4 per cent!

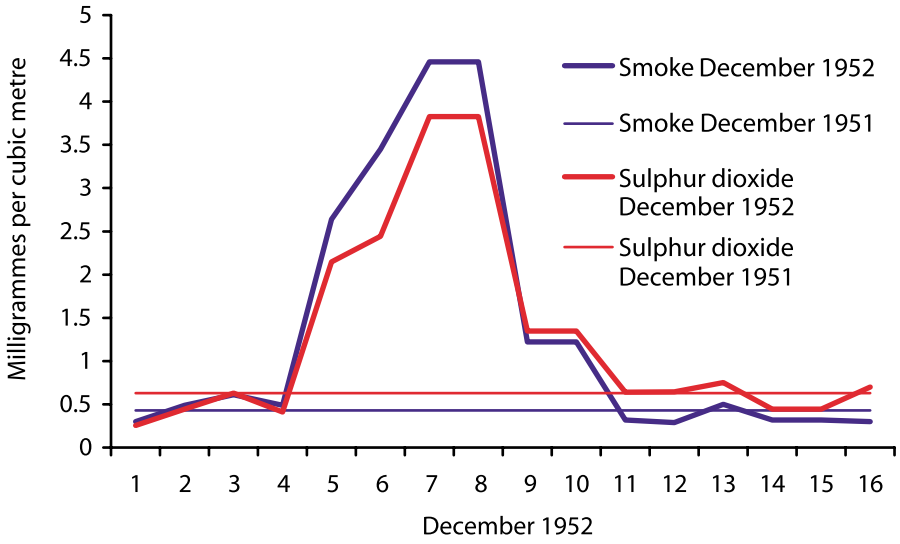



**Figure 1**
**Smoke and sulphur dioxide concentrations at County Hall during the London smog of December 1952 compared to the average concentrations in December 1951**

*Source:*
*London County Council 1953*

The Ministry of Health committee made an estimate of the number of deaths that occurred as a result of the smog by comparing the number of people that would normally have been expected die with the number of deaths actually registered, during the week of the smog and subsequently.

A comparison between the excess of deaths registered in the weeks ending 13 and 20 December and those occurring in the preceding weeks, as well as the average for the corresponding weeks for the years 1947 to 1951, produced estimates of the number of deaths caused by the smog ranging from 3,412 to 4,075. On this basis the committee concluded that between 3,500 and 4,000 deaths had occurred as a result of the smog, and that a figure nearer 4,000 was the best estimate that could be made.

Information from the death certificates filed in the General Register Office and the results of autopsies carried out by coroners' pathologists show that the main causes of death were respiratory and cardiovascular disease.

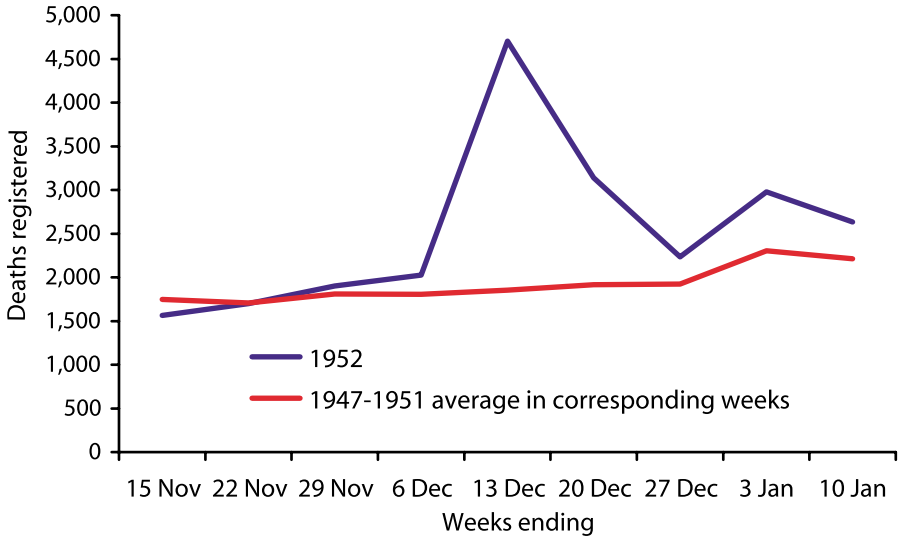
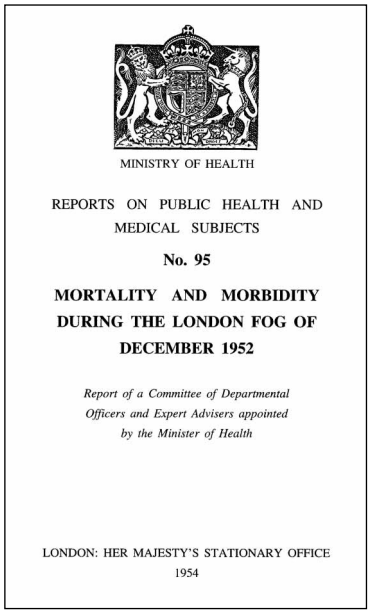



**Figure 2**
**Deaths registered during the London smog of December 1952**

*Source:*
*Ministry of Health 1954*



MINISTRY OF HEALTH

REPORTS ON PUBLIC HEALTH AND MEDICAL SUBJECTS

No. 95

**MORTALITY AND MORBIDITY DURING THE LONDON FOG OF DECEMBER 1952**

*Report of a Committee of Departmental Officers and Expert Advisers appointed by the Minister of Health*

LONDON: HER MAJESTY'S STATIONARY OFFICE
1954

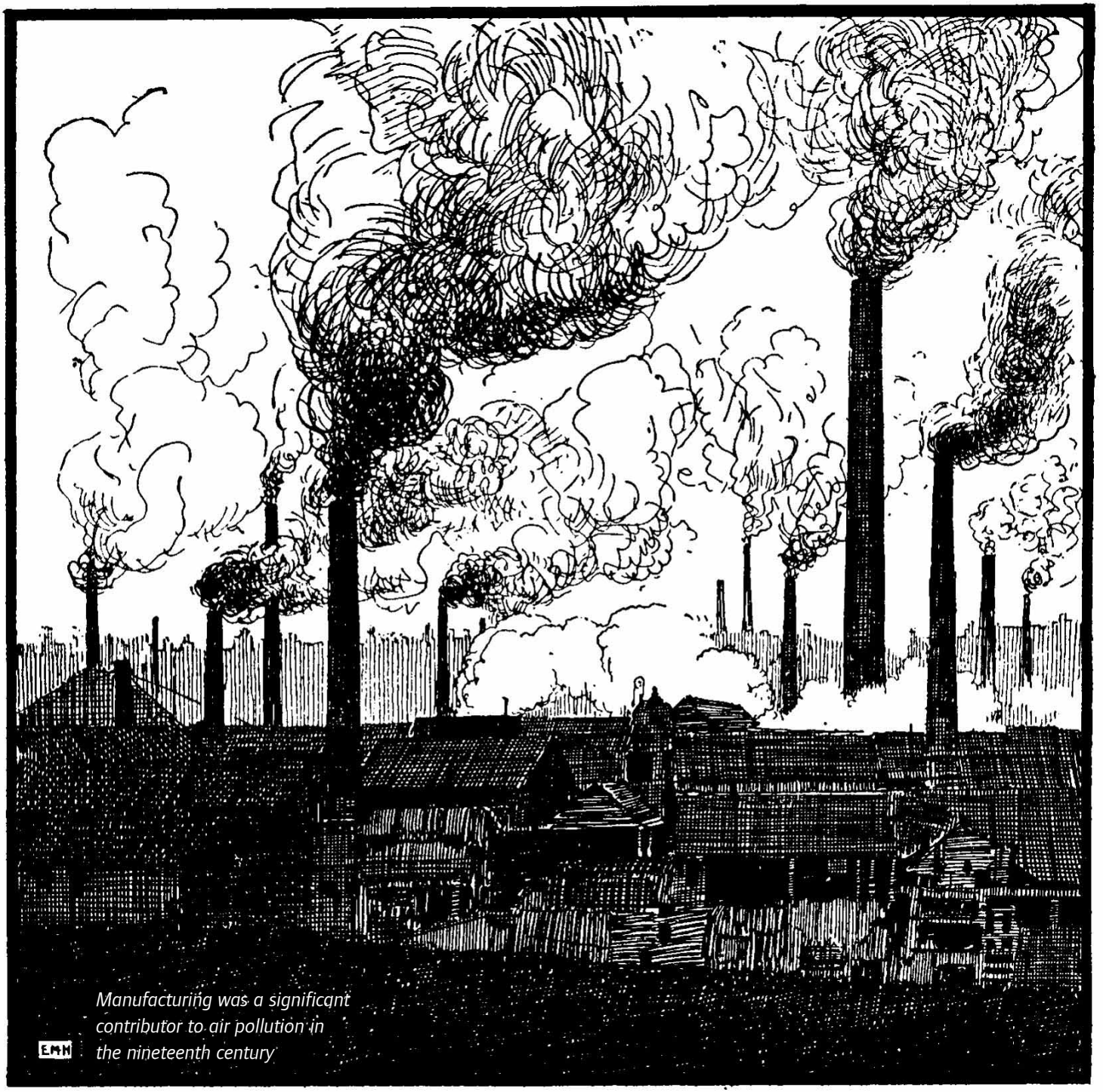
*October 1953*
*Office workers try out the new smog masks that doctors have suggested be worn*

Respiratory diseases alone accounted for 59 per cent of the increase in deaths registered in the week ending 13 December and 76 per cent in the following week. Bronchitis and emphysema were the two conditions that stood out in the coroners' records as showing the greatest increase. Cardiovascular disease accounted for 22 per cent of the increased number of deaths in the first week and 16 per cent in the week ending 20 December.

There was much less information available on the morbidity (sickness) that resulted from the smog. The routine surveys of sickness that had been carried out during the Second World War had ended in 1951. Nevertheless, the Ministry of Pensions and National Insurance statistics showed an increase in sickness claims by 108 per cent in the week ending 16 December compared to the average in the preceding three years. The rise in sickness claims was much smaller than the increase in deaths, which is undoubtedly due to the fact that sickness claims only related to the working population. The mortality statistics showed that the smog had the greatest effect on people over 65 and those already suffering from chronic ill health.

There was no detailed analysis of the smog available to indicate all the constituents that might have had an adverse effect on health. The *Interim report* of the Committee on Air Pollution[5], published in December 1953 (see the next section), identified particles of tarry matter and oxides of sulphur as the most likely causes of ill health. The irritant properties of sulphur oxides were well known, and a limit of industrial exposure to $SO_2$ of 2.86 mg/$m^3$ had been recommended. However, there was evidence that much lower concentrations produced adverse effects. It would be reasonable to suppose that these effects would be more pronounced in people with respiratory and cardiovascular disease.

To the great majority of normal, healthy individuals the smog was little more than a nuisance. The increased morbidity, of which there was clear evidence, mainly occurred amongst people with pre-existing respiratory or cardiac disorders. As far as could be ascertained, there were no deaths among previously healthy people. The committee concluded that the main irritants responsible were probably those derived from the burning of coal and coal products. However, with the knowledge available then, it was impossible to say that any one pollutant was the cause of death.



*Manufacturing was a significant contributor to air pollution in the nineteenth century*

# air pollution control

There have been three distinct strands to the evolution of air pollution control, as it affects London, over the past 150 years. Pollution control looked firstly at the nuisance caused by smoke and the control of industrial processes, moving on to the setting of ambient air quality standards more recently. These strands have gradually come together but even today, they are covered by separate legislation.

*Illustration from the 1961 reprint of John Evelyn's* Fumifugium

## Control of smoke nuisance

Smoke was recognised as a problem long before the great London smog of December 1952. Indeed, it must have been a problem ever since people first started to make fires to cook food, to keep warm and to work metals. It had long been recognised that London in particular had an air pollution problem resulting from the burning of coal, with a Royal Proclamation prohibiting the burning of sea coal as early as the thirteenth century. In 1661 John Evelyn presented Charles II with a treatise on the problem of smoke entitled *Fumifugium: or the Inconvenience of the Aer and Smoake of London Dissipated*[6]. He suggested that smoke pollution would shorten the lives of people living in London.

Until the early nineteenth century, attempts to deal with the smoke problem were local and sporadic. In 1819 a Select Committee was set up by parliament to consider the problem of smoke from steam engines and furnaces, and whether they could be operated in ways that were less prejudicial to public health and comfort. The Select Committee concluded that smoke was indeed prejudicial to health. It was this report, Lord Ashby said on the twenty-second anniversary of the December 1952 smog, that marked the beginning of the long gestation that ended in the Clean Air Act 1956[7] In 1843 a Select Committee expressed the hope that black

IMPORTANT MEETING OF SMOKE MAKERS.

smoke from fires and private dwellings might eventually be prevented, but another Select Committee in 1845 (based on the then state of knowledge), recommended that action should be limited to furnaces used to generate steam.

In 1851 the City of London secured powers under the City of London Sewers Act to control smoky furnaces and, under pressure from the Court of Common Council, these powers were extended to the whole of the urban area two years later. The cartoon above appeared in *Punch* in 1853, caricaturing a meeting held to protest against the Smoke Nuisance Bill. Arguments put forward in favour of smoke included its curative and antiseptic qualities. Sulphurous gasses were believed to act as a tonic! However, the bill was passed and the Smoke Nuisance Abatement (Metropolis) Acts 1853 and 1856 empowered the police in London to

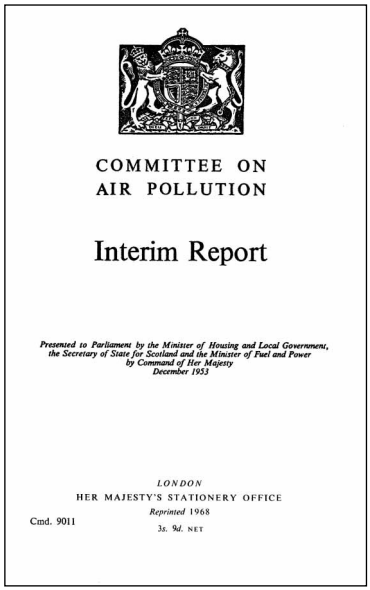
take action against furnaces used to raise steam, factories, public baths and wash houses, and steam vessels on the River Thames.

These Acts continued in use in London until the passing of the Public Health (London) Act 1891 which transferred responsibility from the police to the sanitary authorities, who were then subsumed into the 28 Metropolitan Borough Councils in 1899. The London County Council (LCC), established in 1889, was given reserve powers to act if a sanitary authority defaulted. The LCC instructed its coal officers to report cases of nuisance from smoke and their reports spurred some authorities to act.

Although by the beginning of the twentieth century there had been some improvement, there remained the problem of smoke from coal burning in private houses. When industrialists were charged with smoke pollution, a commonly used defence was to cite the 95 per cent of smoke that came from chimneys of 700,000 houses in London. The LCC even seemed to accept the view that 'the open fire is such an essential feature of our national home life that any attempt to abolish it is almost out of the question.' Another problem lay in the wording of the legislation which referred to 'black' smoke. In order to proceed successfully against a smoke nuisance, it had to be proved to be black. Convictions were rare.

The government's initial response to the December 1952 smog was to deny that it had any responsibility in the matter or that there was any need for further legislation, even though the LCC produced a report in January 1953 clearly detailing its appalling effect. Harold Macmillan, the Minister for Housing and Local Government at the time (later to become Prime Minister), said: 'I am not satisfied that further general legislation is needed at present.'[8] He urged local authorities to use the powers that they already possessed. Ian Macleod, the Minister for Health, was reported in *The Evening Standard* as protesting: 'Really you know, anyone would think fog had only started in London since I became a Minister.'[9]

*'A thoroughbred November and London particular' Aquatint by M Egerton 1827. Dickens describes fog as a 'London particular' (ie a London characteristic) in* Bleak House



COMMITTEE ON
AIR POLLUTION

Interim Report

*Presented to Parliament by the Minister of Housing and Local Government, the Secretary of State for Scotland and the Minister of Fuel and Power by Command of Her Majesty December 1953*

*LONDON*
HER MAJESTY'S STATIONERY OFFICE
*Reprinted 1968*
Cmd. 9011
*3s. 9d. NET*

*Dominating the south London skyline Battersea power station belched out smoke until 1983*

Eventually, the government gave way to pressure from MPs and the LCC, announcing that a committee of inquiry would be set up under the chairmanship of Sir Hugh Beaver. The committee published an interim report after only four months and its final report a year later. The Ministry of Health also published the report covered in the previous section.

Sir Hugh Beaver's committee was asked to look at the general problem of air pollution, wherever and in whatever form it occurred, but the interim report[10] focused on the air pollution arising from fuel combustion in relation to the London smog. 'The domestic fire is the biggest single smoke producer. In ratio to the coal burnt, it produces twice as much smoke as industry and discharges it at a lower level.' The interim report recommendations included that the authorities should ensure that there

were adequate supplies of smokeless fuels available, that the public should be urged to use only smokeless fuels during periods of persistent smog, and that the Meteorological Office should issue warnings when persistent smog was likely to occur. Recommendations in the final report[11] included the creation of smokeless zones in which emissions of smoke would be entirely prohibited and smoke control areas in which domestic use of bituminous coal would be restricted, as well as the provision of grants for the conversion of domestic fires to burn smokeless fuels.

Even after the publication of the reports by Sir Hugh Beaver and the Ministry of Health, the government was reluctant to act. Several MPs therefore decided that, if they won the ballot for a private members' bill, they would introduce a Clean Air Bill. Gerald Nabarro won the ballot and introduced a bill based heavily on the Beaver report. It was withdrawn, however, when the government promised to bring forward its own bill. Although weaker than Gerald Nabarro's draft, the government bill became the Clean Air Act 1956.

The Clean Air Act 1956, which was later amended and extended by the Clean Air Act 1968, constituted the primary legislation limiting pollution by smoke, grit and dust from domestic fires as well as commercial and industrial processes not covered by other pollution control legislation. The Acts regulated the burning of solid, liquid and gaseous fuels, and controlled the heights of new industrial chimneys that were not covered by other legislation. Under the legislation grants were made available for the conversion or replacement of domestic grates to burn smokeless fuels.

The 1956 Act is probably best remembered for its introduction of Smoke Control Areas, often referred to as 'smokeless zones'. Within a Smoke Control Area, it is an offence to emit smoke from a chimney unless it happens to be the result of burning an authorised fuel. Such fuels are specified in regulations and include solid smokeless fuels.

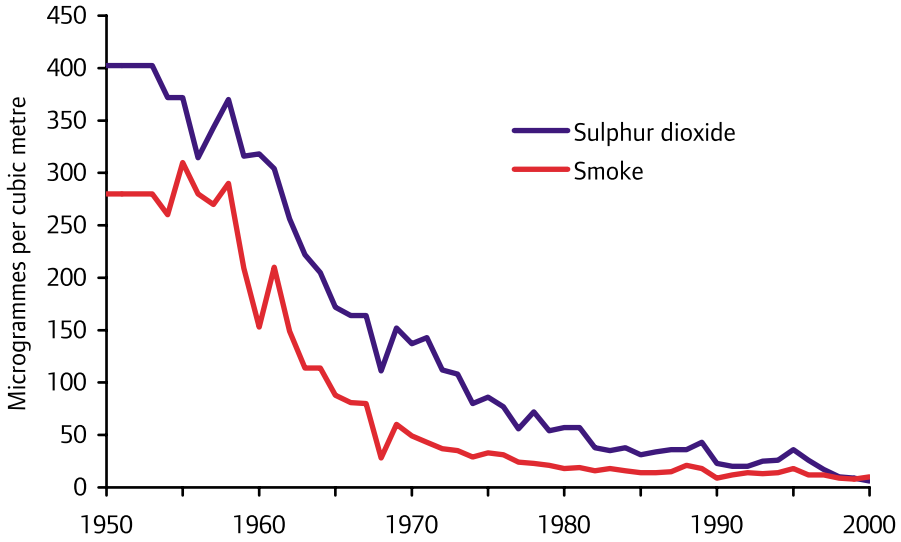
London local authorities responded positively to their new powers and the Metropolitan Borough of Holborn was the first local authority in the country to complete it designation of Smoke Control Areas in 1962. By 1969, when the Greater London Council undertook a review of the effectiveness of smoke control for the London Boroughs Association, over 60 per cent of premises and over 50 per cent of the area of Greater London had already been covered. The study concluded that 'the boroughs have been right to press ahead quickly with the imposition of Smoke Control: firm control and a small expenditure on behalf of the community has yielded a clear profit for the community as a whole'[12].

Figure 3 below shows how London's air quality has continued to improve in respect of smoke and sulphur dioxide. The Clean Air Acts have been very effective in reducing emissions of these two pollutants.

**Figure 3**
**Annual average smoke and sulphur dioxide concentrations in London 1950 to 2000**

*Source:*
*AEA Technology Environment 2002*

*Note:*
*Before 1954 data was only published as 5-year averages*



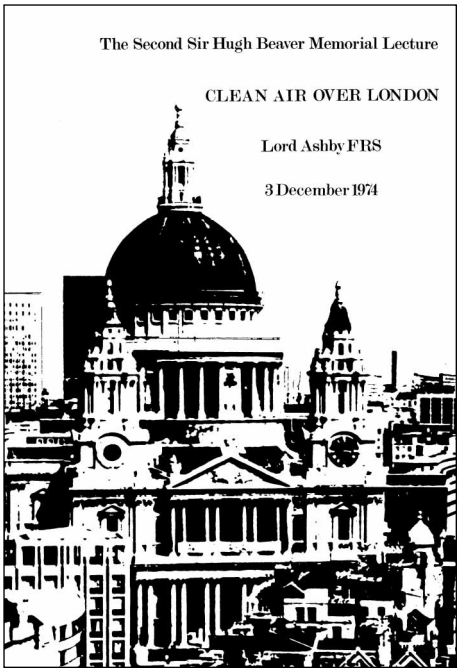
The 1956 and 1968 Acts were consolidated in the Clean Air Act 1993. It also incorporates clean air legislation previously covered by other Acts such as the Control of Pollution Act 1974. Part IV of the Act, for example, regulates the quality of petrol and diesel fuel whilst Part V enables local authorities to carry out investigations and research relating to air pollution. However, the Act does not apply to industrial and other processes covered by the Environmental Protection Act 1990 and the Pollution Prevention and Control Act 1999 (see below).

## Control of air pollution from industrial processes

Air pollution from industrial processes began to become a serious problem during the Industrial Revolution. Alkali works, mostly producing sodium carbonate from salt from the 1820s onwards, produced large volumes of hydrogen chloride gas and an unpleasant smell. Local authorities tried, unsuccessfully, to deal with the problem by banning them, without making any constructive suggestions about how to deal with the problem. All too often the nuisance continued unabated. In 1862 a Royal Commission was set up to examine the problem.

The Royal Commission led to the production of the Alkali Act 1863 which adopted a new approach. The Act required that 95 per cent of the offensive emissions should be abated[13]. The second Alkali Act 1874 required the adoption of the 'best practical means' to prevent the release of noxious and offensive gases, a principle first applied under local powers in Leeds in 1842. The general principle has remained a cornerstone of industrial air pollution control in the UK, although it has been amended by recent legislation and is now the 'best available technique'.

The 1874 Act also introduced emission limits for the first time – setting the limit for hydrogen chloride at 0.2 grains per cubic foot (0.46 grammes per cubic metre). The Alkali Inspectorate was set up to implement the Act, and remained in operation until 1983 when it became Her Majesty's

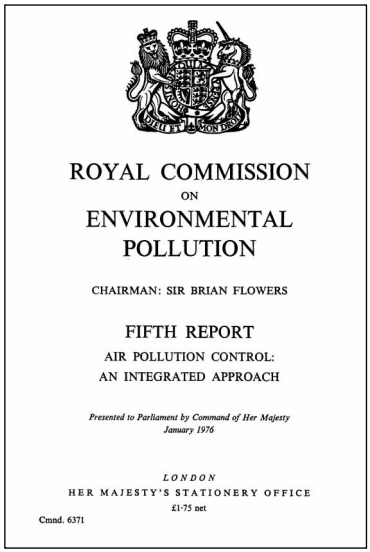

The Second Sir Hugh Beaver Memorial Lecture

CLEAN AIR OVER LONDON

Lord Ashby FRS

3 December 1974

*Report of Lord Ashby's lecture given on the twenty-second anniversary of the great smog* *(see page 11)*


ROYAL COMMISSION
ON
ENVIRONMENTAL
POLLUTION

CHAIRMAN: SIR BRIAN FLOWERS

FIFTH REPORT
AIR POLLUTION CONTROL:
AN INTEGRATED APPROACH

*Presented to Parliament by Command of Her Majesty*
*January 1976*

*LONDON*
HER MAJESTY'S STATIONERY OFFICE
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Industrial Air Pollution Inspectorate. In 1987, it was absorbed into the unified HM Inspectorate of Pollution, which was itself absorbed into the much larger Environment Agency in 1996.

The main mechanism for minimising air pollution from industrial sources is now Part I of the Environmental Protection Act 1990, which repealed the earlier legislation. This Act established two pollution control systems: 'integrated pollution control' which is administered by the Environment Agency and covers the larger and more hazardous processes, referred to as Part A processes, and 'local air pollution control' for the smaller and less hazardous Part B processes which is administered in London by the London boroughs. Both the Environment Agency and the boroughs are required to ensure that pollution from industry is minimised through the use of the best available techniques, subject to an assessment of the costs and benefits. In 1999 there were 70 Part A and 1,313 Part B processes in London[14].

'Integrated pollution control' is gradually being replaced and 'local air pollution' control is being modified by a new system of 'pollution prevention and control' which is being introduced to meet the requirements of the 1996 EU Integrated Pollution Prevention and Control Directive[15]. Although the terminology used differs slightly, the principles underpinning the old and new systems are the same. However, under the new arrangements, permits will be required for a larger number of industrial installations, including some that are currently regulated by the London boroughs, as well as a number which will be new to control. Regulators will also be required to take a wider range of environmental impacts into account. Part B installations that are not covered by the Integrated Pollution Prevention and Control Directive will continue to have emissions to air regulated by the London boroughs. Integrated Pollution Prevention and Control: a Practical Guide[16] has been prepared by DEFRA to promote understanding of the new system.

## Standards for ambient air quality

The setting of standards for air quality, which is now an accepted part of air quality management and included in the Mayor's Air Quality Strategy, has its origins in the 1973 European Communities Programme for Action on the Environment. The Commission of the European Communities established a procedure under which it asked member states to agree levels of pollutant concentrations which were not to be exceeded after a given date. The first of these Directives relating to air quality, covering smoke and $SO_2$, came into effect in 1980[17].

The former Greater London Council (GLC) favoured what it saw as a move towards 'preventative measures'. It regarded the move by the European Communities towards a planned rather than a reactive approach to pollution control as a desirable development[18]. This view was not shared by the Royal Commission on Environmental Pollution which opposed the setting of standards in its 1976 report on air pollution[19]. It wrote: 'While we welcome the intent to improve air quality… we do not think that the achievement of this aim by imposing rigid statutory limits is either wise or practical. We believe that such limits would be unenforceable in practice and would bring the law into disrepute.' The Commission favoured much looser and non-statutory guidelines, but was at the same time critical of the GLC's initiative in attempting to develop its own guidelines[20].

The Environment Act 1995 required the government, for the first time, to produce a national air quality strategy containing standards and objectives, and measures to achieve the objectives. This was first published in 1997. The standards and objectives are derived from the EU Air Quality Framework Directive[21] and the daughter Directives, which identify twelve pollutants for which limit or target values will be set. They are sulphur dioxide, nitrogen dioxide, particulate matter, lead, carbon monoxide, benzene, ozone, polyaromatic hydrocarbons, cadmium, arsenic, nickel and mercury. Some of the national objectives are stricter

than those in the Directives and/or may have earlier dates for compliance. 1,3-butadiene has also been added to the list of pollutants.

The Environment Act 1995 also established a system of local air quality management. This required local authorities periodically to review and assess the current and future quality of air in their areas. A local authority must designate an air quality management area in places where any of the objectives set out in regulation are not likely to be met in the relevant period and where people are likely to be exposed.

*Lots Road Power Station supplied electricity to London Underground from 1905 to 2002. Originally coal-fired, it was first converted to burn heavy fuel oil in 1969, then to dual oil and gas firing in 1977 and closed in 2002*

# changing fuel use

It was generally recognised that one of the main causes of the smog in December 1952 was the widespread use of coal. Sir Hugh Beaver's Committee on Air Pollution described the domestic fire as 'the biggest single smoke producer'. In 1952 coal supplied 61 per cent of London's energy needs, and 28 per cent was accounted for by house coal alone. If the coal burnt in power stations and to produce 'town gas' – this was a time before the arrival of gas from the North Sea – was included, the proportions were even higher. Figure 4 illustrates the way in which fuel use has changed over the past 50 years.

The start of the decline in the use of house coal, from about 1957, coincided with the rapid growth in the use of oil. The economy was growing strongly and oil was favoured as a cleaner and less labour

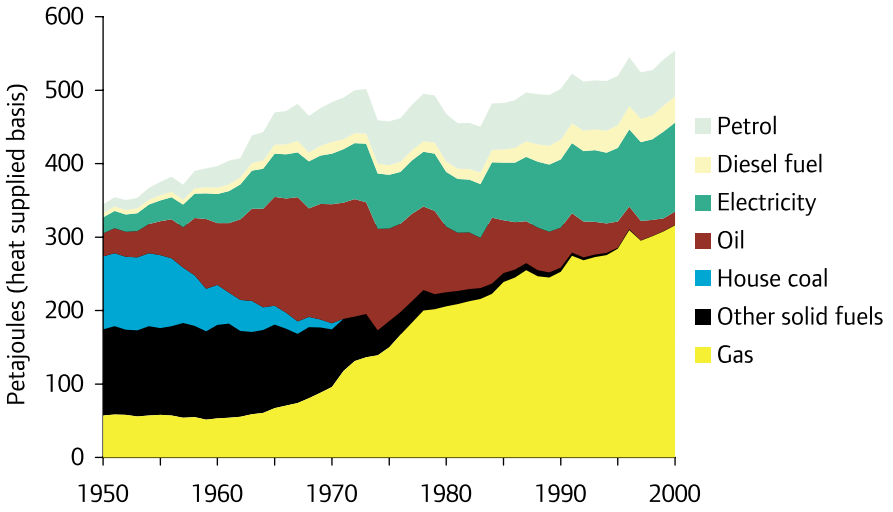



**Figure 4**
**Energy use in London 1950-2000**

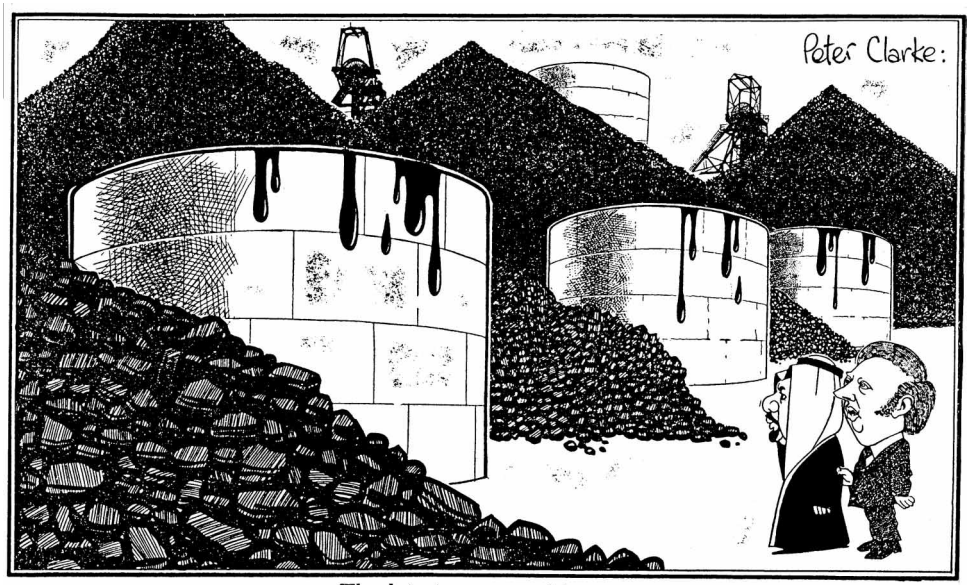
*Source:*
*Greater London Authority*

intensive fuel. For example, many school boilers throughout London were converted to burn oil in place of coal or coke. Oil use continued to grow steadily until the first 'oil crisis' in 1973/4 when the Association of Arab Petroleum Exporting Countries quadrupled the price of oil.

Natural gas was discovered in abundance in the North Sea in 1965, and in 1967 a national programme began to convert boilers and other gas burning equipment to use natural gas in place of town gas. Initially gas started to replace coal while oil use continued to grow. However, the high price of oil and the uncertainty over supplies resulting from the first 'oil crisis' in 1973/4, and the second 'oil crisis' in 1979 following the revolution in Iran, made gas much more attractive to industrial and commercial customers. Indeed, demand rose to the extent that commercial gas prices were initially raised as a restraint, and then when demand could not be met, the British Gas Corporation had to use its statutory power to refuse to supply new customers requiring more than 25,000 therms (2.6 terajoules) per year.

Atmospheric concentrations of smoke and sulphur dioxide fell steadily after 1952, as figure 3 has shown, but nevertheless, in the late 1970s the GLC was concerned about compliance with the impending European Communities Directive on smoke and sulphur dioxide[22]. The GLC approached the British Gas Corporation to see if a programme could be established for the replacement of coal and heavy fuel oil by gas, particularly in central London, as a means of further reducing smoke and sulphur dioxide emissions. British Gas was unable to support a substitution programme because it would have not been able to meet the resultant demand.

Oil prices began to decline from 1981 and then fell sharply at the end of 1985 and through 1986, but by then gas had captured almost all of the coal market and 60 per cent of the market met by oil at its peak in 1973




The latest energy crisis . . .

in London. A cartoon from that time eloquently illustrates the 'energy crisis' facing Sheik Yamani, the Saudi Arabian Oil Minister on the left, and. Arthur Scargil, the President of the National Union of Mineworkers.

The Clean Air Act 1956 had a dramatic effect on reducing the use of coal for domestic heating, and started the process of improving London's air quality. That the process has continued for 45 years is remarkable, and is very largely due to the availability of natural gas from 1965 onwards.

# the Mayor's Air Quality Strategy

The Mayor is required under the Greater London Authority Act 1999 to prepare an Air Quality Strategy saying how the government's national air quality objectives will be achieved in London[23]. The government has set targets for nine main air pollutants. Seven of these pollutants (nitrogen dioxide ($NO_2$), fine particles (or $PM_{10}$), sulphur dioxide ($SO_2$), carbon monoxide (CO), benzene, 1,3-butadiene, and lead) have to be addressed at the local level, including in London, while the other two (ozone and polycyclic aromatic hydrocarbons) are being tackled by national and European Union measures. Given London's size and existing levels of pollution, achieving the government's targets will be very challenging. The government recognises this and has said that achieving them needs to be balanced with London's other priorities.

Measures in *The Mayor's Air Quality Strategy* and other Mayoral strategies will improve London's air quality and London is expected to achieve the national targets for five of the seven pollutants. However, it is estimated that London will not achieve the annual mean $NO_2$ target set for 2005, and daily mean $PM_{10}$ target set for 2004. Levels for both pollutants are expected to exceed their targets along the major road network. In addition, $NO_2$ levels are also expected to exceed the target in central London and in west London around Heathrow Airport, as the maps at the end of this section show.

## Causes of pollution

Road traffic is the major cause of $NO_2$ in London's air, as shown in Figure 5 below, accounting for approximately 60 per cent of emissions in London. A further 21 per cent of emissions are from residential and commercial gas use. Air travel from Heathrow Airport contributes both

directly and indirectly to high levels of $NO_2$ in west London.

Seventy per cent of the $PM_{10}$ emitted in London is from road traffic, but this accounts for only one third of the total $PM_{10}$ measured in the air. The remainder comes from the conversion of other pollutants into $PM_{10}$, from dust swept into the air, from construction activities, industrial processes, trains, ships, aircraft, off-road vehicles and from emissions from outside London, carried in by the wind.

## Reducing pollution from road traffic


The sheer volume of road traffic in London puts tremendous pressure on the capital's environment. *The Mayor's Transport Strategy* and *draft London Plan* set out measures that aim to reduce traffic in central London. Through investment in the public transport network, congestion charging, appropriate planning and other mechanisms, the aim is to stop traffic growth in inner London and reduce the growth in outer London. Most of

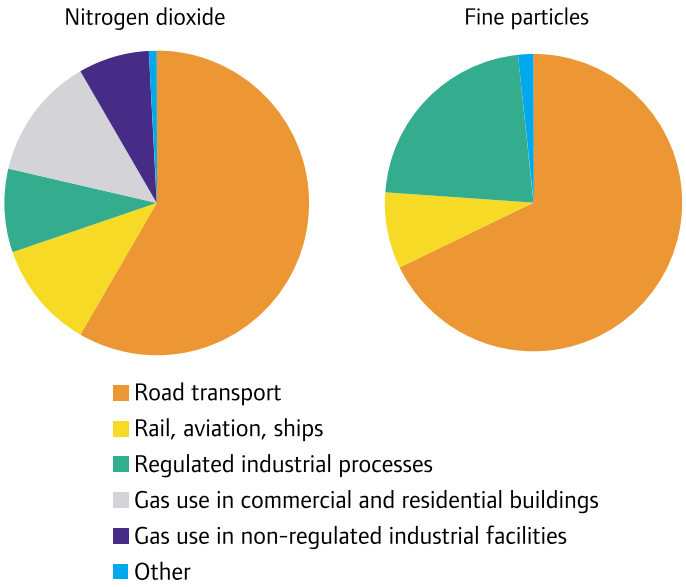



**Figure 5**
**Sources of emissions within Greater London in 1999 affecting nitrogen dioxide ($NO_2$) and fine particles ($PM_{10}$)**

*Source:*
*GLA/TfL London Atmospheric Emissions Inventory*

the increased demand for travel will be accommodated on greatly expanded and improved public transport services.

Newly manufactured road vehicles are becoming progressively cleaner, as is the fuel they run on, mainly due to EU regulation. However, cleaner vehicles are not replacing the older vehicles fast enough to achieve the air quality targets. The Mayor aims to accelerate the introduction of cleaner road vehicles and to take advantage of technological progress to reduce emissions of vehicles already on the road by:

- in the short term, targeting emissions reductions from the most polluting vehicles (mainly heavier diesel vehicles, such as buses, coaches, goods vehicles, waste vehicles, and taxis)
- increasing the take-up of newer, cleaner vehicles and technologies
- increasing the take-up of cleaner fuels
- investigating the feasibility of introducing one or more low emission zones in London, which would exclude the most polluting vehicles from specified areas
- for the long term, promoting 'zero emission' forms of transport, such as hydrogen fuel cell vehicles.

## Reducing emissions from air travel

London's transport links with the rest of the world – primarily air travel – are of central importance to the development and growth of its economy. Passenger travel and goods transport have increased significantly at London's airports over the last decade and this trend is set to continue.

The Mayor has limited powers to affect many of the causes of air pollution around Heathrow. However he can affect how people get to and from the airport and *The Mayor's Transport Strategy and draft London Plan* encourage a shift towards public transport. *The Mayor's Air Quality Strategy* sets out the additional steps that the Mayor would

like the operators at Heathrow and the regulators, including the government, to take.

## Sustainable buildings

A significant proportion (21 per cent) of air pollution in London comes from energy use in buildings, particularly for heating. This source is expected to become more significant as emissions from other sources, such as road transport, reduce and as London's population grows. The Mayor will work to achieve reductions in emissions from buildings by:

- constructing more energy efficient new buildings
- improving the energy efficiency of existing buildings
- installing more energy efficient equipment
- using cleaner fuels
- using renewable energy technologies such as solar water heating.

## Reducing pollution from industry and construction

Most of the heavy industry that existed in London in the 1950s has now either closed or relocated outside of the capital. The remaining industry has become much less polluting as a result of increasing levels of control by the Environment Agency and the London boroughs. The Mayor has few powers over London's industry, but will work with these other organisations to ensure that emissions are reduced where possible.

It is estimated that at any one time London may have as many as 10,000 active construction sites. Construction sites contribute to levels of $PM_{10}$ in London, and the Mayor will develop best practice guidance to encourage action on construction sites to reduce emissions.

## Leading by example

It is very important that the Greater London Authority group of organisations set an example in reducing pollution. *The Mayor's Air*

*Quality Strategy* sets out a series of measures being taken to minimise pollution caused by the GLA's activities including:

- Continuing to improve the Transport for London (TfL) bus fleet, so that it is the cleanest in the UK. By 2005, all 6,400 vehicles will be a minimum of the Euro II vehicle emissions standard with a particulate trap.
- Extending the use of water-diesel emulsion fuel in all TfL London buses. This reduces exhaust emissions that form nitrogen dioxide by 13 per cent.
- Introducing new regulations to reduce emissions from licensed taxis.
- Developing further measures to expand and improve public transport in London, enabling people to change from car travel to less polluting means of transport.
- Ensuring that the GLA group adopts green purchasing policies and encouraging environmental best practice from all companies with which the GLA has a contractual relationship.

## The role of the boroughs

The boroughs are legally required to review air quality in their area, assess their ability to meet government targets, and produce air quality action plans to improve air quality where these targets are not likely to be met.

All London boroughs are required to have regard to *The Mayor's Air Quality Strategy* when undertaking their air quality work, and to ensure their local development plans are in general conformity with the Mayor's London Plan. The Mayor has set out a number of measures in his *Air Quality Strategy, draft London Plan, Transport Strategy and draft Energy Strategy* for the London boroughs to take forward to improve London's air quality.

## The role of business

Business-related road traffic and energy use are a significant source of air pollutant emissions in London and businesses therefore have a particular responsibility to improve air quality. *The Mayor's Air Quality Strategy* sets out a number of measures that businesses are encouraged to take, including:

- ensuring all vehicles meet cleaner emissions standards (at least the Euro II standard plus a Reduced Pollution Certificate or Euro III by 2005)
- introducing travel plans to encourage staff and visitors to use the most environmentally friendly means of transport, such as walking, cycling and public transport, wherever possible
- using government grants to help convert vehicle fleets to the cleanest technologies and fuels
- buying goods and services based on an understanding of the impact their choices will have on air quality, and participating in environmental management schemes to reduce the overall impact of their operations on air quality and energy use
- reporting their business' emissions and demonstrating continuing and meaningful improvements in environmental performance
- adopting renewable energy technologies
- improving indoor air quality in the workplaces.

## The role of individual Londoners

Most of us contribute to air pollution in some way, and all of us suffer the consequences through the air we breathe. We can, collectively, make a difference to London's air quality, by making small changes to the way we live and travel.

The *Mayor's Air Quality Strategy* sets out measures that we as individuals can all take to improve air quality including:

- using public transport rather than travelling by car


*Objective set for 2005 exceeded above this level*

**Figure 6**
**Modelled 1999 annual mean $NO_2$ levels (in µg/$m^3$)**

*Source:*
*OS data © Crown copyright. All rights reserved (GLA) (LA100032379) (2002)*


*Objective set for 2004 exceeded above this level*

**Figure 7**
**Modelled 1999 daily average $PM_{10}$ levels (in number of days above the national target)**

*Source:*
*OS data © Crown copyright. All rights reserved (GLA) (LA100032379) (2002)*

**Figure 8**
**Modelled 2005 annual average $NO_2$ levels (in µg/$m^3$)**

*Source:*
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*Objective for 2005 exceeded above this level*

**Figure 9**
**Modelled 2004 daily average $PM_{10}$ levels (in number of days above the national target)**

*Source:*
*OS data © Crown copyright. All rights reserved (GLA) (LA100032379) (2002)*


*Objective for 2004 exceeded above this level*

- buying cleaner vehicles
- improving vehicle maintenance and driving style
- taking energy efficiency measures such as installing loft insulation or turning lights and heating off when not needed.

## Making it happen

The Mayor will work in partnership with the government, the boroughs, business, other organisations and individuals to improve London's air quality. The maps in Figures 6 and 7 illustrate the levels of $NO_2$ and $PM_{10}$ in London's air in 1999. Figures 8 and 9 show mapped projections of future air quality for $NO_2$ in 2005 and $PM_{10}$ in 2004. They take into account the measures in *The Mayor's Air Quality Strategy* together with current national and EU policies.

While the maps show a clear improvement, even with the measures in this strategy, the targets will not be met and the Mayor is urging additional national and EU action to enable London achieve them. This should include:

- further incentives to increase the use of cleaner fuels and vehicles
- measures to encourage the take up of grants for cleaner vehicles
- action to reduce emissions from aircraft.

The Mayor will also lobby the government and the EU to ensure that emissions from sources outside the capital that affect London's air quality are reduced.

*The Mayor's Air Quality Strategy* recognises that the goal of improving air quality to a level where it does not pose a risk to health is very challenging in London. Nonetheless, the strategy sets itself the aim of achieving the national and European Union targets in the shortest possible timescale, consistent with London's other environmental, social and economic priorities.

# notes and acknowledgements

The GLA wishes to thank the following people for their help in preparing this document:

| | |
|---|---|
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## Notes

**1** The word 'smog' was first used by Dr Des Voeux in 1905 to describe the combination of smoke and natural fog that London used to experience. More recently it has been applied to the brown haze created by emissions of nitrogen oxides and hydrocarbons from motor vehicles in strong sunlight in cities such as Los Angeles. This is more accurately referred to as 'photochemical smog'

**2** These assessments included: Ministry of Health *Mortality and morbidity during the London fog of December 1952* Reports on Public Health and Medical Subjects 95. London: HMSO, 1954. 'Smog' a report of a discussion meeting in *Quarterly Journal of the Royal Meteorological Society*, Vol 80 No 344, April 1954, pp 261-278. Medical Officer of Health *Fog and frost in December 1952 and subsequent deaths in London.* Report to the Health Committee, London County Council, 19 January 1953

**3** For more information visit the MetOffice web site at: http://www.metoffice.com/education/historic/smog.html

**4** In 1952 parts of Greater London lay within the administrative counties of Kent and Essex. It was not until 1965 that Greater London became an administrative area in its

own right
**5** Committee on Air Pollution. *Interim report*, Cmd. 9011, London: HMSO, 1953
**6** John Evelyn, *Fumifugium: or the Inconvenience of the Aer and Smoake of London* Dissipated. Reprint. Brighton: National Society for Clean Air, 1961
**7** Eric Ashby (Lord Ashby), *Clean air over London - The Second Sir Hugh Beaver Memorial Lecture 3 December 1974*. Brighton: National Society for Clean Air, 1974
**8** *Hansard HC*, 27.1.1953, col 829
**9** *Evening Standard* 24.1.1953, quoted in Hansard HC 8.5.1953, col 842-3.
**10** See note 4 above
**11** Committee on Air Pollution *Report*, Cmd. 9322, London: HMSO, 1954
**12** D Plank, 'The progress and effect of smoke control in London', *GLC Research and Intelligence Unit Quarterly Bulletin*, No 10, March 1970, pp 49-55
**13** National Society for Clean Air *Pollution Handbook 2001*, Brighton: National Society for Clean Air, 2001, p 43
**14** Mayor of London *Cleaning London's air - The Mayor's Air Quality Strategy*. London: Greater London Authority, 2002, pp 187 and 196
**15** 'Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control' *Official Journal of the European Communities* L 257, 10 October 1996, pp 26-40
**16** Department for Environment, Food & Rural Affairs Integrated Pollution Prevention and Control: a Practical Guide Edition 2 London: Department for Environment, Food & Rural Affairs
**17** 'Council Directive 80/779/EEC of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates' *Official Journal of the European Communities* L 229 , 30 August 1980, pp 30-48
**18** Greater London Council *Thirty Years On: A Review of Air Pollution in London*. London: Greater London Council, 1993
**19** Royal Commission on Environmental Pollution *Air Pollution Control: an Integrated Approach*. Fifth Report Cmnd. 6371. London: HMSO, 1976, pp 50-51
**20** Greater London Council 'London's Air – Guideline Concentrations', Joint report of the Planning Committee and the Public Services Committee, *Council Minutes, 22 July 1975*
**21** 'Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management' *Official Journal of the European Communities* L296, 21 November 1996, pp 55-63
**22** See note 16 above
**23** Mayor of London Cleaning London's air - The Mayor's Air Quality Strategy. London: Greater London Authority, 2002. Also available on the web at: http://www.london.gov.uk/approot/mayor/strategies/air_quality/index.jsp

*December 1952*
*A bus emerges from Fleet Street at Ludgate Circus into the glow of the emergency fog lighting. The picture was taken in the early afternoon*

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