

A History of Urban Air Pollution

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1. Introduction

Air pollution has a long history. It is well known from short notes that introduce many reviews of air pollution drawing attention to its early development. In addition there are thematic histories that deal with mechanisms, the science of aerosols (e.g. Preining and Davis, 2000), regulation (e.g. Ashby and Anderson, 1981). The most popular are the attempts at the history of air pollution although again these have generally aimed to describe the air pollution at specific locations. Thus we have histories of London, Manchester, York, the Ruhr for example (Bowler and Brimblecombe, 1990; Bowler and Brimblecombe, 2000; Brimblecombe, 1987b; Bruggemeier and Rommelspacher, 1992; Mosley, 2001).

Here, although I will talk about individual cities, I want to develop some general ideas that characterise the history of urban air pollution.

The startling changes in the way we view our environment in recent years has made it easy to forget that concern over air pollution is not restricted to the late 20th C. The history of

the environment is useful because unfamiliar contexts can throw issues into sharper relief.

2. Protohistory

Some of the earliest evidence of air pollution comes from archeological materials (Brimblecombe, 1987b), such as soot deposits in mummified lung tissue or increased incidence of sinusitis, that attest the prevalence of indoor air pollution in primitive dwellings of great antiquity (Brimblecombe, 1998; Skov et al., 2000).

Outdoor pollution became significant with the development of populous cities or centres of industrial activity. Policy decisions regarding air pollution are known from classical times. In ancient Greece, the *astynomoi* (controllers of the town) tried to make sure that pollution sources were well beyond the city walls. Sextus Julius Frontinus (AD ~30-100) oversaw water supply to imperial Rome in a systematic and professional way and recorded his approach in the book: *De Aquaeductu Urbis Romae*. He believed his actions also improved Rome's air, a notion that seems justified on medical grounds because The Hippocratic Corpus had linked air and health via miasmatic theories of water-

borne disease (Brimblecombe, 1987a; Brimblecombe, 1998).

Civil claims over smoke pollution were brought before Roman courts almost 2000 years ago (Brimblecombe, 1987a). Cities of the ancient world were often small, but the inhabitants lived at a high density, which led to pollutants becoming concentrated. However industrial processes often took place in forests where fuel was abundant or near mining operations. The same distinction proves true of pollution on the Asian Pacific rim where examples of pollution from early copper smelting are well known (Satake, 2001; Sawa, 1997)



Fig. 1 Here Hiroshige print

A sketch of a smoke plume from some kilns in rural Japan. This comes from a the picture by Hiroshige: Lime kilns at Hashiba Ferry, Sumida River from One Hundred Famous Views of Edo (Drawing by Phillip Judge).

and much of the concern would have resulted from the sulfur pollutants. This could cause local problems, but the exposed populations were small, because the sites were in rural areas.

The growth of coal as a fuel was especially significant in creating air pollution problems. In 13th C London wood was in short supply, so the strange smelling coal smoke from the new fuel was associated with disease and thought severe enough, by the 1280s, to need regulation (Brimblecombe, 1987b). Although it is easy to find legal concern about environmental pollution in ancient documents it tended to lead to ad hoc responses rather than a strategic and coherent approach to regulation. Mieck (1990) has argued that the numerous pollution decrees from the Middle Ages are essentially a response to single sources of what he terms pollution artisanale. These were usually just one particular type of pollution and distinct from the later and broader pollution industrielle, that characterised an industrialising world.

Although there was some improvement in London's air in subsequent centuries this was probably more from population shifts and a return to wood-fuel rather than legislation. By the 1500s coal was again on the increase, especially as a domestic fuel for London. Concern over its effects now extended to the deposits of soot around the city and on clothes and gardens. There were comparisons between London and Paris. In London the problem was seen as coal smoke, while in Paris it was taken to be the reduced sulfides from putrefaction of

organic rubbish tarnished silverware (Brimblecombe, 1987b). Silverware remained a key problem in cities with horse drawn traffic as both ammonia and these sulfide tended to spoil the shiny surface.

Scientists and demographers of the 17th century, such as Sir Kenelme Digby, John Evelyn and John Graunt, took an active interest in coal smoke and its health effects and argued for legislation. Medical description of respiratory diseases induced by air pollution improved significantly in the 18th century, but few writers were activists, willing to press for improved air quality.

In these earliest periods where the pollution may be highly localised it is often the product of fuels and in particular fuel change. The drivers for this change might typically be economic and lead to a perceptible change in air quality that evokes protest. This is particularly seen in the medieval transition from wood to coal in London, but once its use became widespread, popular objections softened.

3. Nineteenth Century

By the late 18th century and certainly the early 19th century a further transition was underway in Europe. It was technological change that pressured for a response to air pollution. Steam engines had far reaching impacts on the structure of our society and cities. Initially there were many objections to the noise and smoke, but in reality the air pollution problems were localised in the

beginning and it may even be that on an urban scale they were minor sources. Nevertheless these noisy smoky and inefficient engines were so obvious to neighbours that they provoked unfavourable comment.

In cities where the adoption of steam engines was rapid, local pressures for control the smoke soon grew. In Manchester, for example, health enthusiasts set up a voluntary Board of Health under Thomas Percival in the late 1700s, which raised the issue of smoke abatement (Bowler and Brimblecombe, 2000). From medieval times smoke and other nuisance offences in English cities were usually addressed through local administrative structures such as the Court Leet. By the 1790s the Manchester Court Leet and its medieval structured ceased to exercise effective control over the growing sanitary problems of the city. Even contemporary writers saw this as an outmoded form of government and it was especially weakened by the growth of industry beyond the jurisdiction of parish boundaries (Bowler and Brimblecombe, 2000). Subsequent developments in the Manchester anticipated the sanitary reforms that became more general in Britain, Europe and North America by the mid-19th C. In the city they began to inspect industrial boilers, chimneys and tried to encourage good practice. The problems of the early 19th C were significant because the locus of population had shifted from the countryside into the increasingly polluted cities. The problem in Mieck's (1990) terms was that the localised pollution artisanale had been replaced by a more serious and widespread pollution industrielle.

Throughout Europe the 19th century was a time of general sanitary reform. Some of the ideas were prevalent in Britain, but they soon became evident elsewhere (e.g. Diederiks and Jeurgens, 1990). This emergent sanitary legislation was responsible for most pressures on air pollution in Britain of the 19th C, although there were some attempts at direct control of industrial emissions for environmental reasons were evident in the Alkali Act (1863). The role of local government was formalised under this type of legislation and its administrative structure began to escape from the clumsy courts and assizes it had inherited from the medieval period. However, the laws concerning smoke abatement did not necessarily prove effective at abating smoke. In the 19th C so much emphasis was placed on economic progress, that industry occupied a privileged position and frequently escaped from local environmental control.

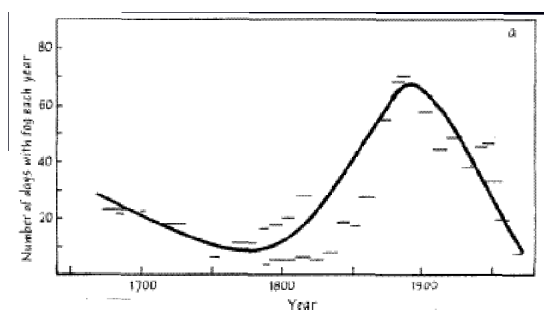


Fig. 2 Fogs in London

Annual frequency of fog in London from early diaries and weather observations (Brimblecombe, 1987b).

Throughout the 18th and 19th C, it is likely that the products of coal burning, smoke and sulphur dioxide, increased in concentration in the air of English cities. Control measures were ineffective, so any improvement may have derived from geographical changes and perhaps the development of public transport systems, which meant that cities could grow rapidly in size and decrease emission density. One marker of the changes was the London fog, which reached its contaminated peak at the end of the 19th C.

The roles of medical officers, sanitary inspectors and ultimately smoke inspectors were strengthened in Britain in the late 19th and early 20th centuries. These officials were responsible for reducing smoke and other nuisances at a local level. Similar changes soon occurred in other countries of Europe and in the United States (HMSO, 1905). There were developments in colonial India (Anderson, 1997) and students from Japan came to Britain to study for sanitary degrees (e.g. Brimblecombe, 2003).

In England sanitary inspectors were often very active and although, the regulations lacked substantive powers the pressures seem to have reduced emissions from furnaces in some locations. Any emission reduction seems to have been brought about through improved stoking, often with the adoption of automatic stokers in the early 20th century.

4. Twentieth Century

The twentieth century began with a broad acceptance of the notion that air pollution was bad for health, although legislation brought only slow improvements. Initially there was a preoccupation with coal derived air pollutants. This culminated with the Clean Air Act of 1956 that came as a result of the London Fog of December 1952, where somewhere between 4000 and 12000 people died from the pollution episode. The legislation although coming late in the history of London's air pollution had to focus on emissions from domestic in addition to industrial sources. This was an important recognition that personal freedom might have to be reduced in the face of environmental pressure (Brimblecombe, 2002).

However, by the 1950's there was already a new type of pollution confronting Los Angeles. Photochemical smogs, the products of volatile fuels and photochemistry had been difficult to recognise at first. This 20th century transition to photochemical pollutants was very much the result of the rising importance of automotive fuels.

A similar air pollution history was evident in Japan with concerns over dust from industry in the last years of the 19th century. After World War II this involved stronger concerns about the smoke that resulted from the growing utilisation of energy. Protests by women in Tobata City who suffered the effects of the air pollution began in 1950. As elsewhere concerns had to evolve from smoke to worries about

trace gases, in particular sulfur dioxide which began to show reductions from 1967 (Sawa, 1997). Parallel changes in Korea saw organisations such as KIST (Korea Institute of Science and Technology) involved in research related to the urban planning of Seoul from 1969 and an increasing focus on environmental problems. As in other cities Seoul has experienced declines in SO₂ through the 1990's.

The complexity of the secondary pollution has meant that it has been necessary to invoke the more involved strategies of air quality management when trying to lessen air pollution and its effects. In the 1990's attention shifted back from gases to particles. Suspended particles had been neglected since the 1960's as coal smoke their most obvious source had declined so much in urban air, but the 1990's revealed that particles in the 2.5 micron range. These particles, often attributed to the use of diesel fuels, played a critical role in health.

5. Generalising the histories

The development of air pollution problems over the last seven to eight hundred years seems to follow consistent patterns. Air pollution has, in this period been related to the history of fuel use and the perceptible change in air pollution that arises from the fuels. Increasing energy demands and the adoption of new fuels (sequentially: coal, petrol, then diesel) have caused air pollution problems. These have typically been visible in terms of smoke, photochemical smog and diesel smoke. The concentration of air pollutants from a given

source, such as coal, seems to increase for a long period and undergo a decline due declining emission strength. The patterns of changing air pollution although similar from one country to another can take place over very different time scales. The changes, which took almost 800 years in Britain seem to have all occurred in about 50 years in China as it is moved from biofuel, to coal and then to oil.

Air pollution problems have not been easy to solve and the slow rate of reform has often interested historians. While on one hand the reluctance of industry to expend money on abatement is often seen as inhibiting improvement, it is also possible that citizens in polluted cities have come to accept the state of the air in their cities. The coziness of the open coal fire, the fear of loss of jobs as industry bore more costs and the implications of personal freedom of not having access to a car or a cheerful coal fire all seem to drive a reluctance for change (Mosley, 2001).

In the last fifty years air pollution problems have also been more global. There is a wide social awareness of the enhanced greenhouse effect, acid rain, the ozone hole and Asian brown haze. Nevertheless these are difficult issues to keep on social and political agendas. People interpret air pollution from local perceptions and it may be difficult to maintain interest in on larger temporal and spatial scales (Bickerstaff and Walker, 2001).

The history of air pollution shows that our atmospheric environment is in a state of

continual change. Problems emerge, reach some kind of crisis and then decline to be overtaken by others. The scales involved have become ever larger, while detecting the pollutants and their effects, have increasing instrumentation rather than human perception. Maintaining social and political interest in problems that are increasingly subtle and complex will remain a challenge.

6. References

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