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The development of effects-based air quality management regimes

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A B S T R A C T

This paper considers the evolution of attempts to control and manage air pollution, principally but not exclusively focussing upon the challenge of managing air pollution in urban environments. The development and implementation of a range of air pollution control measures are considered. Initially the measures implemented primarily addressed point sources, a small number of fuel types and a limited number of pollutants. The adequacy of such a source-control approach is assessed within the context of a changing and challenging air pollution climate. An assessment of air quality management in the United Kingdom over a 50-year timeframe exemplifies the range of issues and challenges in contemporary air quality management. The need for new approaches is explored and the development and implementation of an effects-based, risk management system for air quality regulation is evaluated.

1. Management in historical perspective

The United Kingdom (UK) has a long history of attempts to control air pollution, with varying degrees of success, including the efforts of John Evelyn in the 17th Century (Evelyn, 1661). Initially attention was focused on the problem of smoke control in wintertime conditions as typified by the London Smog of 1952 (see Brimblecombe, 1987; NSCA, 2002) where air pollution was principally determined by patterns of coal consumption. The subsequent government-appointed Beaver Committee's (see Brimblecombe, 1987) investigation into the causes, consequences and future control measures led to the introduction of a targeted legislative regime in the form of the Clean Air Act, 1956 (HM Government, 1956a). From the perspective of the early 21st Century it is interesting to recall Williams' (2002) observation that the Act made no reference to such contemporary air quality management tools as concentrations, standards or guidelines, nor did it offer any explicit recognition of the concept or importance of public exposure to the pollution.

In parallel with the concern over smoke pollution in towns and cities in the 19th and early 20th centuries, the UK sought to bring industrial air pollution within a control regime that was focused on the point of release, but recognised that some air pollution was inevitable. Attempts to control polluting industries began with the creation of the Alkali Inspectorate under the 1863 Alkali Act (Environmental Protection UK, 2008).

The subsequent Alkali Works Regulations Act, 1906 (HM Government, 1906) provided the first legislation directly controlling specific industrial emissions and was updated periodically. This Act linked a list of works considered likely to cause air pollution with a list of noxious and offensive gases related to the processes. The works schedule included chemical industries, petroleum refineries, petrochemicals, electricity generation, coal carbonisation, iron and steel works, non-ferrous metals and mineral processing works. This was the first of a series of Acts of Parliament in the 20th Century that were designed to manage either industrial or domestic air pollution, as shown in Fig. 1.

Under the Acts, Her Majesty's Inspectorate of Pollution (HMIP) and its predecessors (including the Alkali Inspectorate) had jurisdiction over certain prescribed processes or works whilst local authorities had control over domestic sources and a selection of the less complicated industrial processes. Control was exercised primarily through emission controls for individual plant using the concept of Best Practicable Means (BPM), but there was little scope for managing the combined effects of multiple processes in the same area. The Public Health (Smoke Abatement) Act, 1926 empowered ministers to add polluting industries to the schedule of works and list new noxious or offensive gases by an order of parliament as a statutory instrument (Environmental Protection UK, 2008). Various industries were added to the schedule over the next 40 years and these were consolidated in the Alkali, etc. Works Order, 1966 (Environmental Protection UK, 2008). This remained in force until the Health and Safety at Work Act, 1974 (HM Government, 1974) and its subsequent regulations came into force. The 1906 Act was eventually repealed when all its functions had been subsumed by either the 1974 Act or later by the Environmental Protection Act, 1990 (HM Government, 1990a). In respect of

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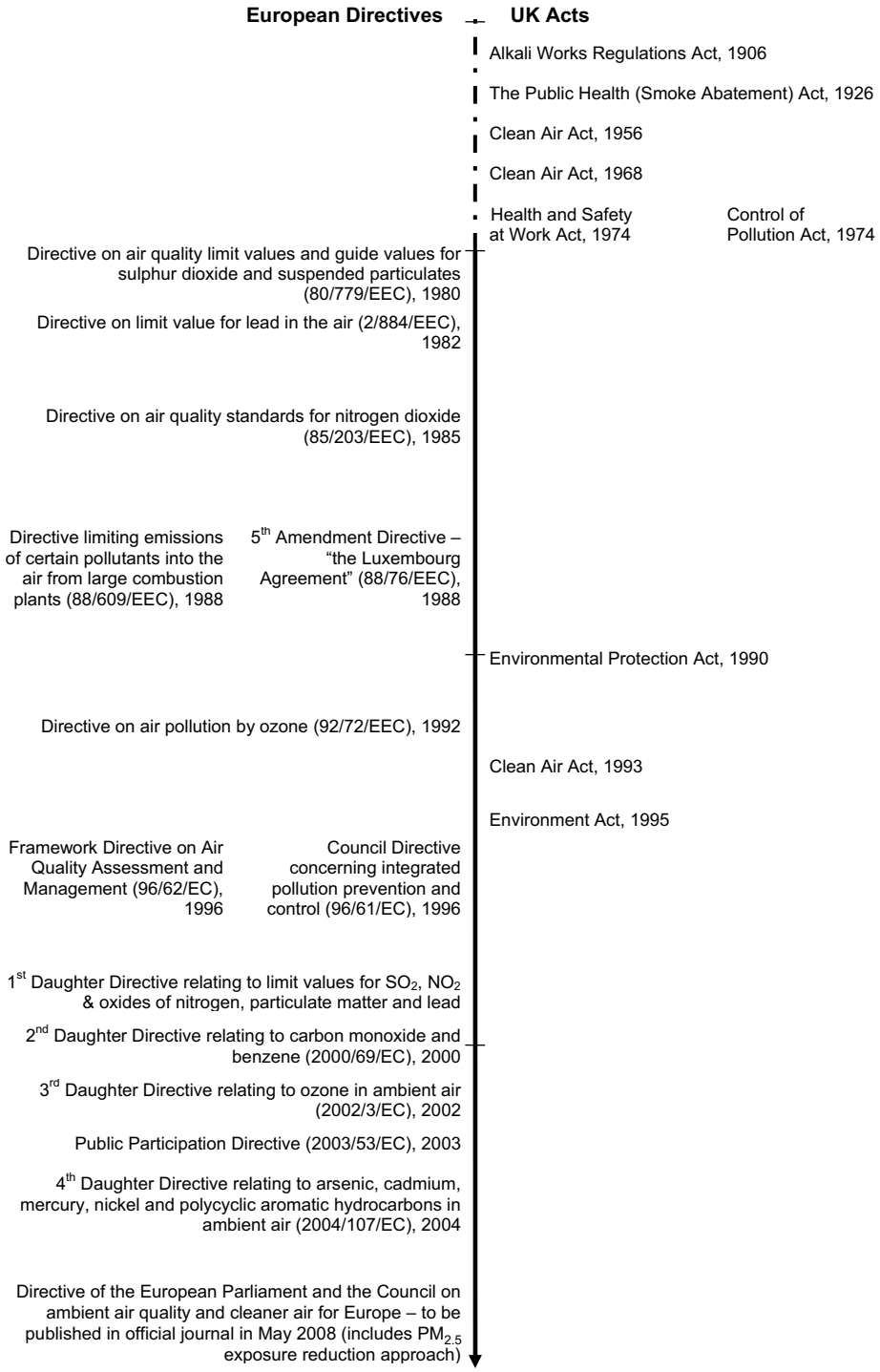

Fig. 1. Timeline of adoption of UK Acts and EU Directives (Environmental Protection UK, 2008).

industrial pollution control, these Acts were enforced by an Inspectorate. By the middle of the 20th Century a flexible control regime for industrial sources was in place which used emission limits and other requirements to allow for acceptable air pollution via the application of BPM (Ireland et al., 1979). This approach, in addition to setting limits, required the awarding of prior approval for air pollution control equipment, prosecution of plant managers where conditions were not met and a regime of continuing inspection and testing of installed control equipment.

Regulatory attention was given to domestic sources primarily through the Clean Air Act which required that domestic coal be burnt in approved appliances which were more efficient, and gave encouragement to the use of smokeless fuels and to other forms of fuel switching such as from coal to oil, gas or electricity. Following the introduction of the Act coal consumption declined in domestic and industrial markets throughout the 1960s and 1970s and the frequency and severity of coal smoke pollution within the UK's towns and cities progressively decreased. The primary control measure applied by local authority regulators was the designation of an area known as the 'smokeless zone' by issuing a smoke control order under the powers granted by the Act. In a smokeless zone, only specified fuels could be burnt, and grants were available to