

## **LEGAL DISCLAIMER**

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## Urban Air Quality Management and Practice in Asian Cities

The severity of air pollution problems in Asian cities reflects the level and speed of their development. This developmental path is one that is current in many cities around the world. Figure 3.1 presents a model of urban environmental transition (McGranahan *et al.*, 2001). As the wealth of a city and its citizens increases the driving forces (e.g. transport demand), pressures (e.g. emissions), state (e.g. air quality) and impacts (e.g. health and environmental detriment) they face move from those that are located mainly in households and communities and impact on the city and urban region (e.g. emissions of particulates that affect urban air quality and have a direct impact on human health) to a global level (e.g. the delayed impact of tropospheric ozone on crops and forests and the emissions of greenhouse gases and global climate change). This results in responses (e.g. regulation, monitoring and enforcement) targeted to a solution of the problems. In very poor cities the problem of household sanitation is usually a severe problem compared to ambient air quality or carbon

emissions. As cities undergo economic and industrial development air pollution becomes an increasing problem together with carbon emissions while the severity of the household sanitation problem decreases. In wealthy cities strict regulation and the implementation of abatement technology has reduced polluting emissions to ensure they meet health guidelines, but this is not without considerable financial cost to the community. However, carbon emissions remain high due to energy intensive activities.

In the past, the major causes of environmental degradation occurred sequentially rather than simultaneously. The combination of driving forces and pressures seldom overwhelmed the natural resilience of urban ecosystems. However, nowadays many Asian cities are having to suffer the pressure of a combination of different driving forces which are occurring simultaneously, each with a greater intensity than has occurred elsewhere or in the past and without the well-developed civil infrastructure and financial resources to control them. The result is that the ability of many

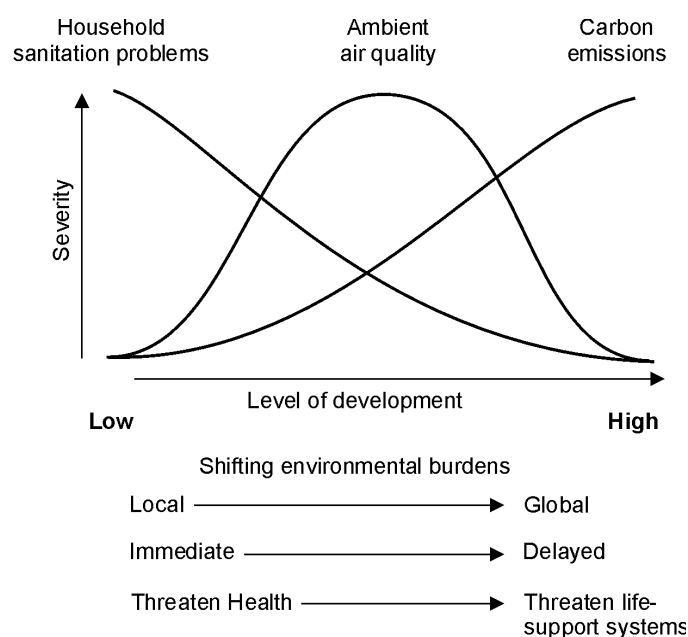


Figure 3.1 Urban Environmental Transition Model  
Source: modified from McGranahan *et al.* (2001)

cities to cope with the combined pressures is often exceeded leading to a deterioration of environmental quality in many major cities in the region (McGranahan *et al.*, 2001).

## Development of Urban Air Pollution Problems

Figure 3.2 relates the development of air pollution problems in cities to the overall level of economic development. The development path of air pollution problems in cities can be divided into five general stages:

- Stage 0 Pre-problem stage
- Stage I Moderate and increasing levels of air pollution
- Stage II High but stabilising levels of air pollution
- Stage III Moderate and decreasing levels of air pollution
- Stage IV Low and decreasing levels of air pollution

Before industrial development, the main source of air pollution was from the domestic sector and light industry. The concentration of air pollution was generally low and increased as population increased. With the start of industrial development, the level of energy use increases substantially and air pollution begins to rise rapidly. Urban air quality becomes a serious public health concern and emission controls are then introduced (UNEP/WHO, 1992).

Many cities in Europe and North America have passed through these stages of air pollution and currently experience relatively low levels of air pollution (see Chapter 4). For example, the City of London (UK), which fifty years ago experienced the 1952 London Smog that lasted for five days and, according to recent research by Bell and Davis (2001), led to approximately 12,000 more deaths than usual. This smog episode resulted in the first UK Clean Air Act in 1956. The Act

aimed at controlling domestic sources of smoke pollution by introducing smokeless zones. Within ten years of the Act being adopted smoke emissions from industry were reduced by 74 per cent with those from domestic sources becomes the main polluter (Clapp, 1994). The introduction of cleaner coals led to a reduction in sulphur dioxide pollution and the move to the use of natural gas reduced domestic emissions. The City's air quality has improved considerably over the past fifty years progressively moving through each stage of development from Stages I to IV. Nowadays, London it is currently addressing the problem of vehicle related air pollution and photochemical smogs. In 12-15 December 1991, London experienced the most severe nitrogen dioxide pollution since regular monitoring began in 1971. One-hour levels of nitrogen dioxide peaked at 809  $\mu\text{g}/\text{m}^3$ , greatly exceeding the 1999 WHO air quality guideline of 200  $\mu\text{g}/\text{m}^3$ . Levels of benzene increased by six to ten times its typical value. The 1991 London smog episode is claimed to have caused 160 extra deaths (Elsom, 1996).

Although many Asian cities have underlying similarities in their air pollution problems, many differences also exist. The extent of economic development is clearly different between the megacities and linked to this is the degree of management capability, role of planning, regulation and enforcement, and the levels of defensive expenditures that alleviate many of the air pollution problems for the population. This is evident in the range of emissions and ambient levels of pollution and variation in the incidence of acute events and chronic conditions found across the 12 cities of this study.

It is the type and scale of human activities that give rise to the emissions and waste streams, and the associated severe conditions of air pollution. This leads to local ambient atmospheric conditions to which the population is committed: the dose commitment is high due to the ambient conditions and the large numbers

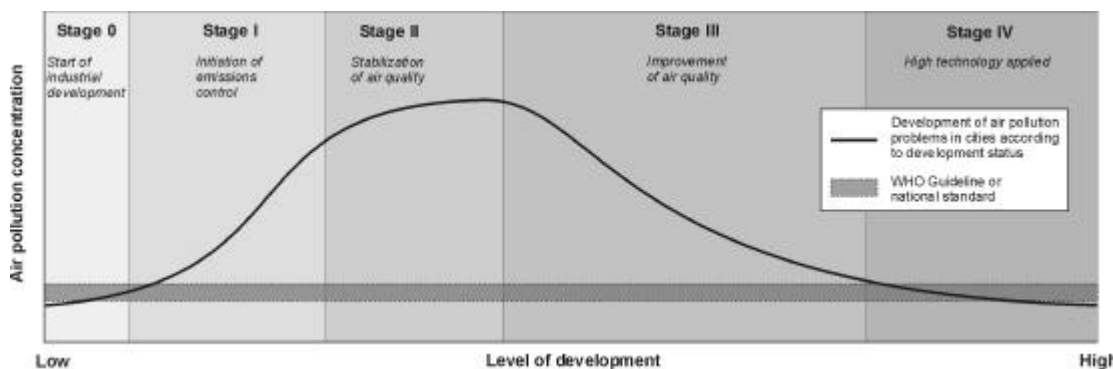


Figure 3.2 Development path of air pollution problems in cities  
Source: modified from WHO/UNEP (1992)

who experience it. Responses to these conditions take the form of policies and regulations for control and amelioration, through enforcement. The effectiveness of these responses can only be fully determined through the monitoring of air pollution and environmental change as well as the long-term monitoring of human health.

Figure 3.3 presents the key elements that form part of an AQM system. Depending on which stage the city is at in the development of its air pollution problems, each key element of AQM will have a different priority and importance for the city. For some cities, air quality monitoring may still be rudimentary and require further expansion while other cities will have a well-developed monitoring systems but require investment in air quality information systems and monitoring of health impacts. The formulation of a strategic framework for common action on urban air quality issues will need to address those elements of AQM which are of most importance given the stage which the city is at in the development of its air pollution problems.

## Benchmarking Asian Cities

Figure 3.4 presents the cities included in this benchmarking exercise. This chapter provides a summary of the results of the first stage of the benchmarking exercise. In this first stage twenty-two city authorities in thirteen Asian countries were contacted to provide information on air quality management. However, this report presents summaries for only 12 cities. Air quality management differs from city to city and country and country. It was therefore not always possible to receive data directly from city authorities. In these cases, national government agencies were contacted since this was where most, in some cases all, the official

urban air quality management data and information were available. Where such data were not available, external data sources were used. For example, the city and country data for emissions concentrations for various pollutants from the WHO Air Management Information System (AMIS) database concentrations were used.

## The Air Management Information System

The Air Management Information System (AMIS) is a programme developed by WHO in 1997 as a successor of the UNEP/WHO GEMS/AIR programme. AMIS has the objective to transfer information on air quality management (air quality management instruments used in cities, indoor and ambient air pollutant concentrations, noise levels, health effects, control actions, air quality standards) between countries and cities. In this context AMIS acts as a global air quality information exchange system. AMIS programme activity areas include:

- coordinating databases with information on air quality issues in major and mega cities;
- acting as an information broker between countries;
- providing and widely distributing technical documents on air quality management;
- providing training courses with respect to air quality monitoring and management; and
- running Regional Collaborative Centres to support data transfer activities, perform training courses and implement twinning projects.

AMIS is a set of user friendly MSACCESS based databases. A core database contains summary statistics of air pollution data like annual means, 95-percentiles, and the number of days on which WHO guidelines are

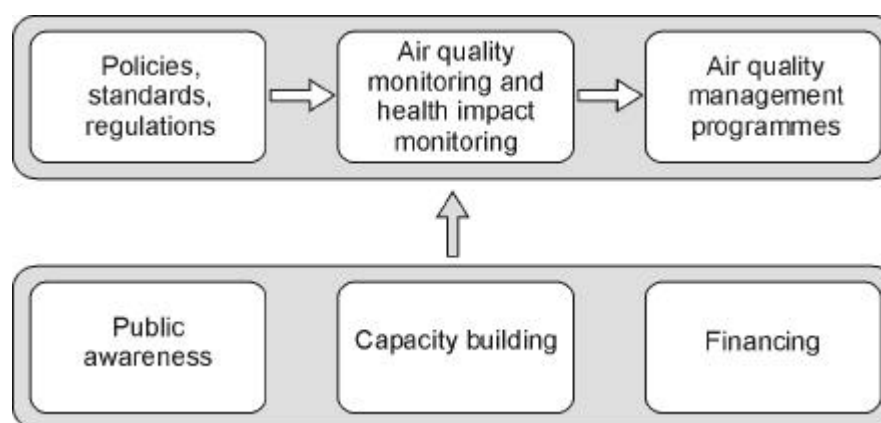


Figure 3.3 Key elements of an AQM



Figure 3.4 Cities included in the benchmarking exercise

exceeded. Any compound for which WHO air quality guidelines exist can be entered into the open-ended database. In the existing version data (mostly from 1986 to 1999) from about 150 cities in 40 countries are represented. Other realised databases include a database on air quality management capabilities, a database on air quality standards, and an indoor air database.

AMIS data on average concentrations of certain air pollutants was used to support the summary information for selected cities covered in this report (see Chapter 5).

## Data Collection

Each authority contacted was requested to complete a questionnaire and to provide data and information on urban air quality management and practice. The questionnaire was based upon the Management Capabilities Index used by the GEMS/AIR study which assessed UAQM capabilities in 20 major cities (see Annex I) (MARC/UNEP/WHO, 1996).

Of the twenty-two cities or national government agencies contacted eighteen provided information in the form of reports rather than completing the questionnaire. Therefore, there still exists significant

gaps in information for this benchmarking exercise.

The results presented here provide an overview of AQM in the following 12 cities: Bangkok, Beijing, Busan, Chongqing, Dhaka, Hongkong, Jakarta, Kathmandu, Mumbai, Seoul, Singapore and Taipei. The following themes were discussed for each city using data currently available:

- situational analysis;
- urban air quality trends;
- air quality monitoring;
- impacts of air pollution;
- enforcement and control strategies.

The results of the Stage I of the Benchmarking exercise will be discussed at the Regional Workshop in Hong Kong in December 2002. It is hoped that further collaboration from city authorities and national governments can be gained in providing additional information on air quality management in order that the final report can provide a comprehensive account of air quality in Asian cities.

Stage II of the Benchmarking exercise will attempt to fill in the gaps in AQM information and make a further detailed assessment using again the questionnaire and including case study examples of practice in Asian cities.