

AIR QUALITY MANAGEMENT IN SINGAPORE

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ABSTRACT

Singapore is a small island city-state and is highly urbanized and industrialized. Singapore has adopted an integrated approach, which comprises prevention, enforcement, monitoring and education, to control new developments to minimize the impact of pollution. This helped Singapore maintain a clean and healthy environment. The ambient air quality is well within the standards set by the US Environmental Protection Agency and World Health Organization. The new challenge Singapore now faces is no longer merely achieving good environmental performance but striving for environmental sustainability. We must find ways to ensure that the air stays clean.

1 INTRODUCTION

- 1.1 Singapore is a small island city-state with an area of about 680 sq km and a resident population of four million. It is highly urbanized and industrialized. Singapore developed its industrial base and achieved high economic growth in less than 3 decades. In tandem with these developments, programmes were also implemented to protect the environment.
- 1.2 The success of these environmental protection programmes is evident today and Singapore has an environment that compares well with that of any nation in the world. All levels of pollutants in the ambient air are within the World Health Organization (WHO) and the United States Environmental Protection Agency (USEPA) standards.

2 ENVIRONMENTAL MANAGEMENT STRATEGY

- 2.1 To ensure that economic growth and rapid industrialization were not achieved at the expense of the environment, the Anti-Pollution Unit (APU) and the Ministry of the Environment (ENV) were formed in 1970 and 1972 respectively to protect and improve the environment. APU implemented measures to control air pollution whilst ENV provided infrastructure and measures to prevent and control water pollution and manage solid wastes. In 1986, APU was merged with the Pollution Control Department of ENV. In Jul 2002, the control of air pollution was placed under the responsibility of the National Environment Agency (NEA), which is a statutory board under ENV.
- 2.2 In Singapore, the strategy adopted to protect the environment comprises the following four key elements:

- (a) Prevention.
- (b) Enforcement.
- (c) Monitoring.
- (d) Education.

- 2.3 Potential problems of pollution can be prevented through proper land use planning and judicious siting of industries, development and building plan control and provision of treatment facilities. Innovative measures are put in place to curb the increase in vehicular population and emissions. Once preventive measures are established, controls are stringently enforced to ensure that treatment facilities are properly operated and maintained.
- 2.4 Routine monitoring of ambient air is carried out to assess the adequacy and effectiveness of the environmental pollution control programmes. In addition, programmes are conducted to educate the public on the protection and management of the environment.

3 LAND USE PLANNING

- 3.1 The Concept Plan provides the long-term plan for the physical development of Singapore. Land for various uses is safeguarded to achieve social and economic development and to maintain a quality environment. Environmental controls are factored into this land use planning to help ensure that developments are properly sited and are compatible with surrounding land uses to achieve a quality environment.
- 3.2 Industrial developments are considered to be non-compatible with residential use. Even with pollution control facilities to comply with emission standards, residual or fugitive emissions of smell, dust and noise cannot be totally eliminated from industries. Although these emissions are well within safe levels, they would cause nuisance problems if residential premises were built too close to industries. To minimize nuisance from industries, adequate buffers are provided between residential premises and industries. In order to optimize land use, other more compatible uses such as commercial, recreational, entertainment, parks, roads and car parks are allowed to be sited within the nuisance buffers of industries.

4 DEVELOPMENT AND BUILDING PLAN CONTROL

- 4.1 A proposed industry will be allowed only if emissions of pollutants can comply with standards, wastes can be safely managed and properly disposed of, and the factory can be sited in a suitable industrial estate. Building plans of new developments are checked to ensure that environmental pollution control requirements are incorporated into designs of the developments to minimise pollution and to mitigate pollution impact on surrounding developments.

- 4.3 For major developments, developers are required to carry out pollution control assessment for their proposals. The study includes an assessment of all pollution impact on the environment and recommendation of measures to mitigate such impact.

5 VEHICULAR EMISSIONS

- 5.1 Given the scarcity of land in Singapore, there is a need to curb vehicle population growth to avoid serious traffic congestion and deterioration in the ambient air quality. Singapore has implemented several innovative measures such as the Vehicle Quota System to ensure that the vehicle population grows in tandem with the increase in road capacity and the Electronic Road Pricing system to manage usage of vehicles.
- 5.2 Singapore has implemented a multi-pronged programme to control vehicular emission. The approach is to introduce measures to curb vehicular emission to pre-empt any deterioration in the air quality as a result of an increase in vehicle population. The strategy lies essentially in the use of improved fuel quality and engine design to ensure that lesser amount of pollutants are emitted per vehicle .

6 LEGISLATION AND ENFORCEMENT

- 6.1 Legislation is enacted to control pollution to protect the environment. The main legislation for air pollution control is the Environmental Pollution Control Act and its subsidiary Regulations.
- 6.2 Regular inspections of industrial and non-industrial premises are carried out to ensure compliance with pollution control requirements. Source emission testing, fuel analyses and smoke observations of chimneys are also carried out. Enforcement action is taken against violations, including vehicles with emissions exceeding stipulated limits.

7 MONITORING

- 7.1 Routine monitoring of ambient air is carried out to assess the adequacy and effectiveness of the environmental pollution control programmes. Data on quality of ambient air are also used to formulate environmental pollution control policies and programmes.
- 7.2 We have adopted the Pollutant Standard Index (PSI) developed by the USEPA as an indicator of ambient air quality. Except for the levels of PM10 in 1994 and 1997 when Singapore was affected by transboundary smoke haze, the rest of the air pollutants (sulphur dioxide, carbon monoxide, ozone and nitrogen oxides) are well within the standards prescribed by WHO and USEPA. The air quality in terms of PSI is summarised in the Annex.

8 EDUCATION

- 8.1 Environmental consciousness is the most critical element in laying the foundation for Singapore's sustainable development into the future. Singapore has, therefore, implemented educational programmes to raise and cultivate awareness and understanding of the environment among the general public and to encourage the population to take an active role in the protection and maintenance of the environment.
- 8.2 Emphasis is given to incorporate environmental education programme in the school curricula. In addition, children participate in field trips to nature reserves, waste disposal facilities, water reclamation plants and waste recycling plants. The schools also organise exhibitions to promote environmental awareness and waste recycling.
- 8.3 NEA also works together with partners in public, private people sectors to carry out education campaigns to reach out to the community, workers, interest groups and the private sector.

9 CHALLENGE AHEAD

- 9.1 The new challenge that Singapore now faces is no longer merely achieving good environmental performance but striving for environmental sustainability. To meet this challenge, Singapore has to take a longer-term view towards striking a balance between development and the environment.
- 9.2 In addition, looking from the global environment perspective, Singapore faces a challenge in our efforts to curb carbon dioxide emission to avert the threat of global warming. Without any endowment of natural resources, Singapore is totally dependent on imported fossil fuels for its energy needs. Because of this dependence on fossil fuels and our economic structure, our emissions of pollutants from combustion in the industrial, transport and power generation sectors will inevitably grow as the economy develops.
- 9.3 Because power generation, industries and motor vehicle emissions are the main contributors to air pollution in Singapore, maintaining good air quality invariably depends on reduction of energy consumption, greater use of cleaner energy, and greater conservation of energy.
- 9.4 A National Energy Efficiency Committee was set up in 2001 to spearhead programmes to encourage more efficient use of energy by industries, homes, commercial buildings and vehicles.
- 9.5 The search for cleaner-burning fuels continues with a major initiative to replace fuel oil with natural gas in power generation and in transportation. Singapore already imports natural gas via two pipelines from Malaysia and Indonesia. A third natural gas pipeline from Indonesia is scheduled to be ready in 2003. The target is for 60 percent of Singapore's electricity needs to be met by natural gas by 2012. Trials using compressed natural gas public buses and taxis are underway. If successful, the use of natural gas may be extended to other types of

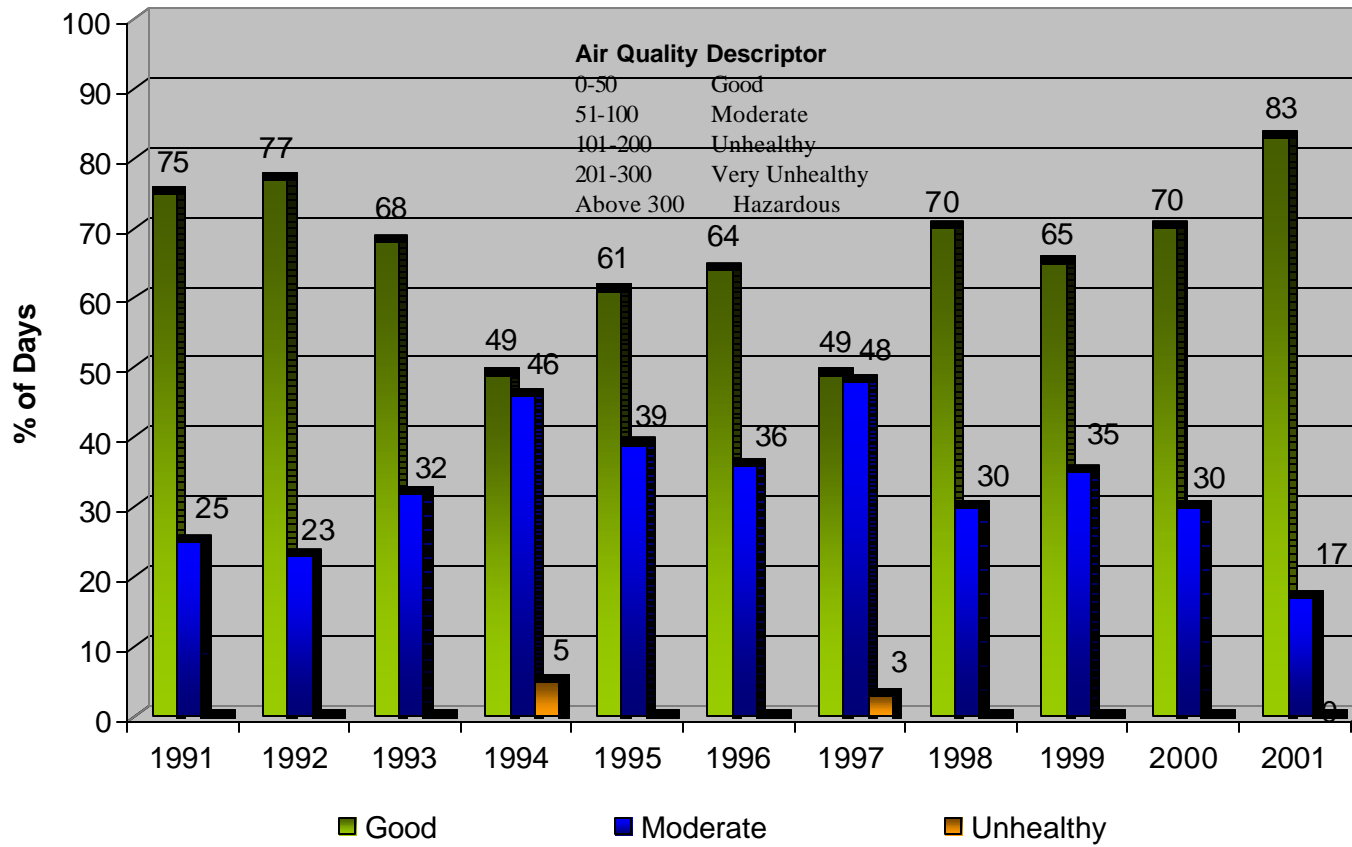
vehicles. Singapore is also encouraging the use of other green vehicles such as hybrid vehicles and fuel cell vehicles.

- 9.6 Solar energy has been identified to be the best potential renewable energy source for Singapore. Research and development projects on photovoltaic (PV) applications, especially incorporating PV panels onto building roof and façade are being undertaken.
- 9.7 To get the most out of energy sources, projects are being undertaken by the private sector to recover waste heat from large industrial plants to power utility systems such as centralized cooling system for district cooling. Industries are being encouraged to make better use of energy by adopting co-generation technology, in which high-grade heat is used to generate electricity and lower-grade heat can be used for other process needs.

10 CONCLUSION

- 10.1 Singapore has adopted an integrated approach to control new developments to minimize the impact of pollution. This helped Singapore maintain a clean and healthy environment. The ambient air quality is well within the standards set by the US Environmental Protection Agency and World Health Organization.
- 10.2 The new challenge Singapore now faces is no longer merely achieving good environmental performance but striving for environmental sustainability. We must find ways to ensure that the air stays clean. Reducing energy consumption, using cleaner energy and conserving energy more will be the key to maintaining good air quality for the benefit of present and future generations of Singaporeans.

AIR QUALITY IN TERMS OF PSI 1991 TO 2001



(Note: Air quality in 1994 and 1997 was affected by the transboundary smoke haze from the land and forest fires in Indonesia)