1 Introduction

1.1 In Singapore, as in any highly urbanised city, emissions from motor vehicles are a significant source of air pollution. The problem of vehicular emission is compounded by the fact that the pollutants are emitted at ground level which is in close proximity to the breathing zones of people.

1.2 Vehicular emissions contribute to ambient concentrations of pollutants such as carbon monoxide, oxides of nitrogen and sulphur, and particulates. At sufficiently high concentrations, these pollutants can cause health problems as well as degrade the environment and quality of life.

1.3 In particular, diesel-driven vehicles emit particulates that are very fine and a large proportion of them are less than 2.5 microns in size. These fine particulates are generally known as PM2.5 and they can penetrate the deeper recesses of our lungs and cause respiratory problems. Studies in the US and other countries have linked PM2.5 to an increase in respiratory diseases and increased mortality. Epidemiological findings have shown that it is prudent to keep PM2.5 level to as low a level as possible in order to protect the health of the population.

1.4 Currently, Singapore has a vehicular population of about 560,000 motor vehicles and 130,000 motorcycles. In addition to this, an average of 30,000 Malaysian registered motorcycles and 3,000 diesel-driven Malaysian registered goods vehicles ply Singapore roads each day. Singapore is a small country. It is, therefore, imperative for us to have a stringent programme to control smoke emission from vehicles to ensure that our ambient air quality remains healthy.

2 Environmental Policies To Control Vehicular Emissions
2.1 The Ministry of The Environment (ENV), together with the Land Transport Authority (LTA), has implemented a multi-pronged programme to control smoke emission from motor vehicles. Besides the programme to control car ownership and usage, the following environmental programme and measures are adopted:

(a) Setting of stringent emission standards for the registration of new vehicles.
(b) Require the use of cleaner fuel, such as unleaded petrol and diesel with low sulphur content of below 0.05%;
(c) Require all in-use vehicles to undergo mandatory periodic inspection and pass the smoke emission test;
(d) Carry out stringent enforcement actions against smoky vehicles on the roads;
(e) Educate vehicle owners on proper vehicle maintenance to prevent smoke emission.

3 Emission Standards & Fuel Quality

3.1 ENV set stringent emission standards for the registration of new vehicles. Over the years, ENV has tightened the emission standards in tandem with advances in vehicle technology. From 1 January 2001, the emission standards have been further tightened and vehicles registered for use in Singapore have to comply with EURO II standards.

3.2 The use of cleaner fuel has a major impact in improving air quality. ENV has over the years gradually required the use of cleaner fuel. The use of leaded petrol has been phased out since 1 Jul 1998. The sulphur content in diesel has been gradually reduced to 0.05% since 1 Mar 1999. The low-sulphur diesel has helped reduce the levels of sulphur dioxide and particulate emissions from diesel-driven vehicles. It has also allowed us to introduce the more stringent EURO II emission standards for diesel-driven vehicles.

4 Mandatory Inspection of In-use Vehicles

4.1 ENV and LTA require all in-use vehicles to undergo mandatory periodic inspection at an authorised vehicle inspection centre at regular intervals. Vehicles that fail the smoke emission tests during the inspection are not allowed to renew their
vehicle road taxes. This is to ensure that vehicles on the roads are properly maintained to prevent smoke emission.

5 Maintenance of Vehicles

5.1 To help vehicle owners to identify motor workshops that can carry out proper maintenance of diesel-driven vehicles to prevent black smoke emission, ENV has worked with the motor trade and industry bodies to introduce a Scheme on Certification of Motor Workshops. The scheme was implemented on 1 Sep 2000.

5.2 Under the scheme, certificates will be awarded only to motor workshops with trained mechanics, proper equipment and procedure, and quality assurance checks for the maintenance of diesel-driven vehicles to prevent black smoke emission. The certification scheme will encourage operators of motor workshops to develop and enhance their technical expertise in maintaining and servicing diesel-driven vehicles. Motor workshops can apply for funding under the Singapore Productivity and Standards Board's Local Enterprise Technical Assistance Scheme to engage technical consultants to help them to identify and bridge the gaps in technical skills, equipment and system so that their workshops can meet the criteria for certification.

5.3 An industry led organisation, known as the Motor Industry Certification Board (Singapore) has been formed to administer the scheme. To-date, 13 motor vehicle workshops have been certified.

5.4 ENV implements the certification scheme on a voluntary basis and encourages vehicle owners to send their vehicles to certified motor workshops for servicing and maintenance in order to prevent black smoke emission. This will help the vehicle fleet owners to upgrade their preventive maintenance programmes for their vehicles to reduce the problem of smoky vehicles on the road.

6 Enforcement Operation

6.1 ENV carries out stringent enforcement operation against smoky vehicles. The owners of smoky vehicles are offered compound fines and required to repair their smoky vehicles and pass smoke emission test.

6.2 With effect from 1 Sep 2000, diesel-driven vehicles that are booked or reported for smoke emission are subject to chassis dynamometer smoke test or CDST, instead of the free acceleration smoke test. The CDST is a more reliable smoke testing method that simulates the actual driving conditions that a loaded vehicle is subjected to while it is on the road. As the CDST measures a vehicle’s emission while it is
“driven” through a simulated drive cycle under load, it will be able to determine if the vehicle has undergone proper maintenance.

7 Education

7.1 Last but not least, ENV educates vehicle owners on the proper operation and maintenance of their vehicles. The most effective way to reduce smoke emission is to carry out proper and regular servicing and maintenance of vehicles. Towards this end, ENV holds regular meetings with vehicle fleet owners to educate them on the need to have proper programme to service and maintain their vehicles, and not to overload their vehicles or drag the engines. ENV also holds regular meetings with the Singapore Lorry Owners’ Association, Singapore School & Private Hire Bus Owners’ Association and the National Association of Travel Agents to ensure that the message of preventing smoke emission permeates down to their members.

7.2 As part of the continuing effort to educate vehicle owners, ENV has published a booklet on the proper maintenance of diesel engines. The booklet will serves as a useful guide to vehicle owners on the proper maintenance of diesel-driven vehicles to prevent black smoke emission. The booklet is printed in the four official languages to reach out to all vehicle owners.

8 Proportion of Smoky Vehicles On The Road

381 As a result of the multi-pronged control programme, the proportion of smoky vehicles plying our roads has decreased over the years. Our survey results have shown that the proportion of smoky Singapore-registered vehicles has decreased from about 8% in 1990 to about 2% currently.

9 Future Direction

9.1 The current levels of pollutants in the ambient air are generally low and well within the long-term goals of the World Health Organisation (WHO) and the primary air standards of the United States Environmental Protection Agency (USEPA). This has shown that the measures adopted to control vehicular emissions, which include both land transport and environmental policies, have worked well in Singapore.

9.2 With vehicle population expected to increase, fuel quality and engine technology would need to be improved in tandem to pre-empt any deterioration in air quality. The use of cleaner alternative fuel technologies such as compressed natural gas and hybrid or electric-driven vehicles will be encouraged. More importantly, public transport will continue to be improved to provide a more efficient and comfortable transportation to encourage Singaporeans to rely more on public transport in the future.