

## Strategies of Mobile Source Pollution Control for Taipei City

### I. Preface

Bureau of Environmental Protection (EPB), Taipei Municipal Government, has been sparing no efforts to improve air quality over the past few years. According to an air-quality survey result, the Criteria Air Pollutants (CAP) of Taipei city are similar to those of other counties and cities on the island, which are mainly ozone and aerosol. Thanks to the cooperative endeavors between EPB and the public, the aerosol index has been descending. However, there is a tendency that the ozone index has been rising annually, suggesting an aggravating situation. In addition, the statistics of pollutant emission amount of Taipei City from 1996 to 2000 suggests that the aerosols (PM<sub>10</sub>) are mainly originated from the dust raised by moving cars (accounting for 54 % to 63 % approximately) and mobile source emission (14 % to 22 %), the sulphur oxides (SO<sub>x</sub>) are mainly from the combustion of point source pollution (accounting for 56 % to 68 % approximately) and mobile sources (32 % to 43 %), nitrous oxides (NO<sub>x</sub>) are mainly from mobile sources (accounting for 76 % to 83 % approximately), and non-methane hydrocarbons (NMHC) are also mainly from mobile sources (accounting for 44 % to 63 % approximately).

Based on the analysis of the data above, we can comprehend that more than exhaust emission from automobiles and motorcycles accounts for 70 percent of air pollution in Taipei City, in which NO<sub>x</sub> and NMHC are the signal substances that eventually generate ozone, a pollutant frequently blamed for deteriorating air quality in municipalities. Having observing these facts, we can conclude that mobile vehicles are the culprit of poor air quality in Taipei City, and therefore also the premier subject requiring immediate improvement. In an attempt to reduce mobile source pollution, EPB has already adopted certain stopgap measures like intensifying inspection and monitoring of mobile sources. However, it is undoubtedly too much for a single agency like EPB to combat against air pollution in a metropolis with so many mobile sources and laborious transport like Taipei. The only way to virtually cement environmental protection while having transport remain unabated is to efficiently coordinate and implement strategies controlling transport.

According to the statistics of Motor Vehicle Supervision Dept. Taipei City, there were a total of 1,641,222 mobile vehicles in Taipei City up to July 2002. The figure for the Greater Taipei Area of Taiwan even topped three million roughly, after adding the number of mobile vehicles in Taipei County. However, it should be noteworthy that a majority of these vehicles were traveling in Taipei City, which may be the key reason behind the persistently high density of air pollutants like ozone in the city.

## II. Strategies of Mobile Source Pollution Control

On the back of air-pollution subsidy, Bureau of Transportation (BOT), Taipei City Government, has been consistently enforcing strategies controlling mobile source pollution. BOT has accomplished these projects, including the 2<sup>nd</sup>-phase demonstration project for natural gas buses of Taipei City, the system of displaying information on the conditions of buses of Taipei City – a project of reducing air pollution by enhancing bus service quality and fostering mass transportation development, the demonstration project of reducing environmental pollution by replacing traffic light controllers of Taipei City, the planning and arrangement of bicycle roads, the planning of bicycle road network for Taipei City, the demonstration project of the 3<sup>rd</sup>-phase natural gas buses of Taipei City, the preferential program for transfer between Mass Rapid Transit (MRT) System and buses, and the training program for staff inspecting gas-carrying vehicles.

Measures for reducing traffic-caused air pollution include the promotion of low-pollution vehicles, inspection and monitoring, strategies of transport system control, and other important traffic construction plans as introduced below:

1. The promotion of liquefied petroleum gas (LPG) vehicles: LPG vehicles are a transport means featuring low pollution, helping reduce emission of NO<sub>x</sub>, CO and HC as well as save fuel expenditures. In 1996 EPB promoted LPG vehicles by granting allowance to those LPG taxies. Currently there are roughly 10,000 LPG taxies registered in Taipei City, with one of the three LPG stations located in An Kang Rd. of Nei Hu District and two in Pin Chiang St. of Sung Shan District.
2. Introduction to natural gas buses: Since 1997 BOT has been implementing that project under air-pollution subsidy. Currently there are already six in-service natural gas buses, with a natural gas station located in Kang Chl Rd. of Nei Hu District. Thus far the NO<sub>x</sub>-and-HC emission has been considerably decreased.
3. Reducing Pollution Caused by Bus Exhaust Emission: “Squid cars”, dubbed by Taiwanese for any vehicles spewing so considerable black smoke and other pollutants as squids do when frightened in the ocean, have long been complained in downtowns. In a bid to solve that long-standing problem, BOT, under air-pollution subsidy, had buses in Taipei City install smoke filters and catalyst converts.
4. Bus Lanes: Currently there are a total of ten bus lanes in Taipei City. Ever since implementing bus lanes, a number of positive effects have been found, such as higher bus speed, more bus passengers, and fewer private transport means.

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5. **Transfer and Shuttle between MRT System and Buses:** In order to encourage the public to take mass transportation means, BOT, under air-pollution subsidy, began implementing a preference program for MRT – bus transfer after Mucha Line was open for service. Since then, the number of MRT commuters has been increasing, while that of private transport means commuters on a decline. That has eventually fulfilled the goal of improving air quality. Following that successful example, we arranged shuttle buses for Tamshui Line and its subsequent lines after they were open for service. Currently, in line with MRT's initial line network fully open for service, the agency keeps expanding the transfer-based preference program and shuttle bus services, with a view set on promoting utilization of mass transportation means.
6. **Chessboard-style & Mainline Bus System:** In order to enhance overall service quality of the bus system, offer the public with straightforward accessibility to the system, and reduce detours and bus stops of the system as a whole, we devised a “chessboard-style” bus network project. Thus far, we have phased into the second stage of the project: reviewing and adjusting current bus routes. Currently we keep pushing forward a total of ten mainline bus routes while keeping the pace of bus lane implementation, a synergy that brings about prompt and convenient transportation.
7. **Computer Signal System:** Coming with the concept of transportation system management, the computer signal system facilitates traffic flow by regulating intersections via the best signals. We expect the system to enhance driving speed and reduce the number of times of stopping and waiting for buses, so as to decrease the power consumption of transportation and thereby bring about a positive effect to municipal transportation as a whole. Thus far we have completed in succession the changeable information signals, intersection controllers, vehicle detectors and closed-circuit television monitoring systems, all of which are connected to our traffic control center.
8. **Regional Traffic Control & Regional Passage Control:** In order to avoid series traffic problems caused by large-sized vehicles, Taipei City has regulated those routes and areas that large trunks and tractor-trailers are prohibited from passage, in accordance with different types and characteristics of routes. That restrictive regulation is implemented on a basis of the whole day, 19:00-22:00 daily, and morning-&-afternoon peak hours daily, and are implemented according to different sections of the routes. In addition, pedestrian lanes are implemented on partial sections of Shimen, and motorcycle lanes or motorcycle prohibition areas are implemented on special sections. During the period of Chinese Tomb-sweeping Day and the flowering season of Yang Ming Shan, regional passage control, shuttle services, instrumental control over freeway ramp metering systems are implemented. All of them have been proven highly efficient

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measures for improving transportation management.

9. Small-to-Medium Bus Route Planning: “The Small-to-Medium Bus Route Planning” and “The Research Project of Air Pollution Reduction” was implemented on the air-pollution subsidy. These projects are carried out with a view set on facilitating the shuttle services and remote-suburb transport for the MRT system, so as to promote the popularity of the mass transportation system and thereby reduce the utilization of private transport means.
10. Light Rail Transit (LRT) System: A project proposed in “A White Paper on Traffic Policy of Taipei City”, the LRT system is expected to alleviate the saturated transport load of bus lanes by coordinating with light rail cars. Powered by electricity, light rail cars are low-pollution transportation means.

### **III. Strategies of Mobile Source Pollution Control**

Bureau of Environmental Protection (EPB), Taipei Municipal Government has implemented strategies to control mobile source pollution for a long time. These measures are devised with a view set on developing the public a habit of regular maintenance and examination for their mobile vehicles, so as to have the pollutants emitted by mobile vehicles within the city comply with related environmental protection regulations and thereby realize the goal of controlling and reducing mobile source emission and pollution. The agency is slated to carry out three keynote projects this year, which are described as follows:

1. Project of On-spot Examining Diesel-fueled Car Exhaust Emission: This project includes inspection into the exhaust emission power of diesels, sampling inspection into the diesel used by these cars, building a diesel-fueled car database for the city so as to facilitate related query and control, organizing campaigns to promote strategies controlling diesel-fueled car exhaust emission, and to encourage and guide diesel suppliers to apply for EPB’s replacement subsidy.
2. Project of Assessing & Inspecting Motorcycle Exhaust Emission Examination & Service Centers Approved by Taipei Municipal Government: It will involve assessment and inspection of motorcycle exhaust emission examination and service centers approved by Taipei municipal government, analysis of assessment results, organizing road shows for assessment results and training and educational courses for related officials.
3. Project of Intensifying Inspection and Control of Pollutants Emitted by Motorcycles (Mobile Source Pollution): It will involve road-blockage inspection into motorcycles to check whether they have been taken regular examination as required, clamping down on those vehicles without taking regular examination and conduction exhaust emission

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inspection into these vehicles, carrying out recurrent examinations on those vehicles reported having emitted excessive exhaust gas until these vehicles pass related examination, and informing the owners of vehicles reported by the public about examination deadline.

Below are the descriptions of the strategies controlling mobile source pollution of Taipei City in the future:

1. Promotion of Low-Pollution Vehicles: Low-pollution vehicles include electric motorcycles, electric bicycles, LPG cars, CNG cars, and those automobiles powered by alternative fuels. We expect, by means of increasing the use of low-pollution vehicles, to reduce pollution source emission, have the emergence of mobile air pollution source under scrutiny, and reduce the amount of such Criteria Air Pollutants (CAPs) as NO<sub>x</sub>, NMHC and CO. Associated tasks will include providing subsidy for purchasing electric motorcycles and replacing their battery, extensive establishment of charger facilities for electric vehicles, launching campaigns to promote the use of other low-pollution vehicles (such as electric bicycles).
2. Survey on Pollution Characteristics: We expect to comprehend the status of pollutant emission via conducting survey on pollution characteristics, so as to facilitate formulating restrictive countermeasures. Eligible CAPs will include TSP, SO<sub>x</sub>, NO<sub>x</sub>, NMHC and CO. We will carry out consistent survey on pollutants emitted by various types of mobile vehicles that are in use, plus the survey on pollution characteristics of aircrafts.
3. Replacement of High-Pollution Vehicles: We will formulate stricter emission standards on and various subsidization measures against mobile source pollution (such as subsidizing replacement of two-stroke motorcycles), with a view set on reducing by years the amount of high-pollution, old vehicles that are in use. Eligible CAPs will include NO<sub>x</sub>, NMHC and CO.
4. Promotion of Automobile Pollution Control Devices: We expect to achieve in reducing emission from pollution sources through subsidizing diesels to upgrade their exhaust emission devices. Associated tasks will include programs of reducing exhaust gas emission of diesels, with TSP as an eligible CAP.
5. Reduction of Motorcycle Pollutant Emission: We are slated to establish a regular examination system for motorcycles through launching inspection, scrutiny and publicity campaigns. Eligible CAPs will include NMHC and CO. Associated tasks will involve launching extensive road-blockage inspection into motorcycles and organizing campaigns to promote the regular examination system for motorcycles.
6. Restrictive Program against Mobile Source Pollution: We are due to hammer out a medium-to-long run plan and restrictive strategy from the viewpoint of overall planning against mobile source pollution in Taipei City, which will serve as a guide for formulating regulation of mobile source pollution in the future. Eligible CAPs will include PM<sub>10</sub>, VOC, SO<sub>x</sub>, NO<sub>x</sub> and CO. Associated tasks will involve integration and renewal of mobile source pollution parameters

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and emission lists of Taipei City, review of changes in mobile source pollution and the control effect in Taipei City, and formulating a practicable solution to controlling mobile source pollution for Taipei City (which will involve pollution-generating transport means, traffic management, planning, management, guidance and promotion solutions to mass transportation, methods of replacing high-pollution vehicles and reduction of traveling miles of these vehicles.

### **IV. Conclusion**

A region with a large population, high industrial and commercial development, and prosperous economic activities, Greater Taipei Area of Taiwan (accounting for 1 /12 of the island in area, and 1 / 3 in population) is laden with more environmental load than other counties and cities on the island. It can be easily to observe the impact on the area generated by the population of Taipei City itself, the population passing in and out of the city, and the amount of mobile vehicles. Currently the air quality of Taipei City ranks at normal to fair levels at large. The Pollutant Standard Index (PSI) remains within a stable range and not aggravating even though an increase in the amount of vehicles. That remarkable achievement should be partly attributable to the joint force between the BOT and EPB, and partly to a comprehensive filing control over constant sources of pollution (which involves tracing control via a reporting system). With such a two-pronged endeavor, we have finally seen inspiring results over years.