CHAPTER 1
INTRODUCTION

1.1 Background and Rationale

Air pollution is an imperative problem in many countries undergoing rapid development. Air pollution is highly generated in urban area by transportation sector. As most of the population is located in urban conglomerations, these areas will have potentially high air pollution impact. Furthermore, air pollution encourages photochemical reactions, ground-level ozone formation and global warming (World Bank, 2001). Bangkok is one such urban area experiencing serious air pollution; the situation worsens especially during rush hours, resulting in lower ambient air quality in the city. Beside, air pollution has significant effects on human health and the quality of life (Bangkok Metropolitan Administration: BMA, 1999).

Currently, the governmental sector has undertaken various measures to alleviate air pollution in Bangkok. These measures include the construction of new roads, implementation of mass transit systems, phasing out leaded gasoline, instituting a requirement for catalytic cars, improvement of emission standards for motor vehicles, reduction of sulfur content of diesel and fuel oil, control of vapor emissions from gasoline tankers and gas stations, control of dust on the road, and introduction of inspection and maintenance (PCD, 2004).

Although some improvement of air quality has been achieved, such as the lead level in ambient air, the study conducted by Pollution Control Department (PCD) indicate that the major source of pollution in the Bangkok urban area is mobile sources (traffic) which generate pollutants including nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (HC), and par ticulate matter (PM) (PCD, 2001). Thus, source control needs to be continued, which should be incorporated into the air pollution control strategies such as mobile source control. Source reduction is an important driving force to prevent air pollution and needs immediate attention before air quality goes out of control.

PCD determined the emission sources of several particular pollutants, referred to as an emission inventory (PCD, 2001). Three major sources (including gasoline and diesel emissions) identified are point sources (industries), mobile sources (traffic) and area sources (residential) of Bangkok in 1997 (PCD, 2001). It was found that emission level were 329,161 tons per year of NO_x, 240,016 tons per year of SO_2, 463,775 tons per year of CO, 38,192 tons per year of PM, and 268,882 tons per year of HC. Ratio of pollutant emission depends on the emission sources. Mobile sources (traffic) are the major generators of NO_x 80 percent, CO 75 percent, PM 54 percent, and HC 87 percent of the total amount of pollutant generated.

Consequently, this study is aimed to probe the major root cause of air pollutants generated from the transport sector in Bangkok. The study also proposes the ideas to reduce and control levels of air emissions from transportation sector. To accomplish such aim and propose, the concept of pollution prevention is approached to the study. Source reduction, as one of the effective mean of pollution prevention for pollutant emissions from transportation sector, is a driven force to this research. The research outputs are presented as the solutions to be the most effective countermeasure to minimizing air emissions, and potentially least expensive, when compared with other solutions for prevent pollutants from transportation sector The current study can be used in formulating policies related to air pollution at a macro level, as the study was focused on that level.

1.2 Objectives

The main objective of the study is to propose air pollution prevention applications for the transport sector in an urban area to minimize the pollution by integration of transport and vehicle emission model.

This can be divided into four sub objectives;

- To apply air pollution prevention technique in order to evaluate the root cause of air pollution problems and alternative solution to such problems.

- To integrate transport and vehicle emissions models that can be used as a tool for prediction of air pollution, and
- To determine the best prevention strategies for air pollution prevention and to present the data using a geographic information system (GIS).

1.3 Scope of study

1. Study area covered 1,568 square kilometers and 430 traffic zones of the Bangkok vicinity, Thailand, as shown in Figure 1.

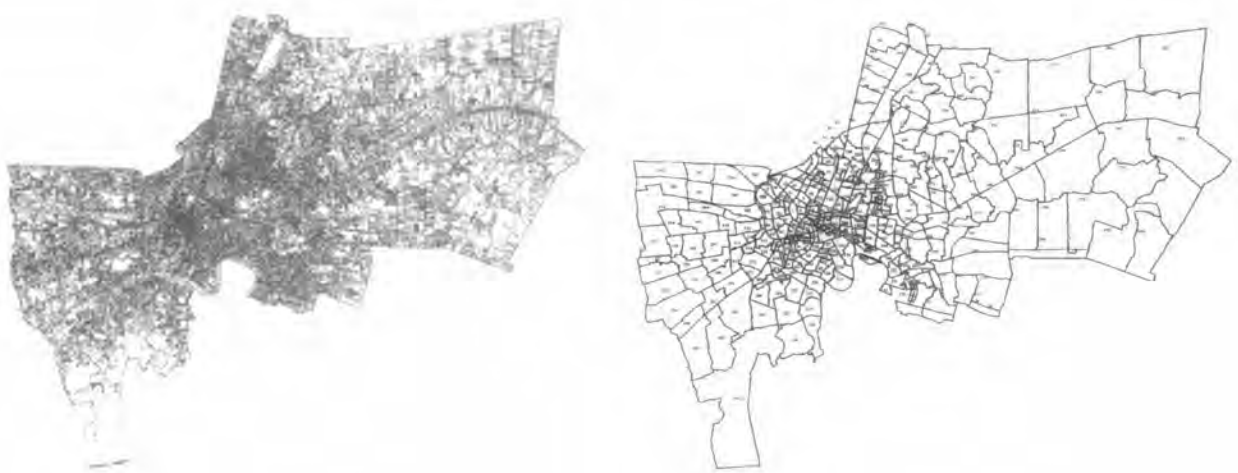

Figure 1 Network and traffic zones of Bangkok, Thailand 2005

2. Developing air pollution prevention techniques by using the guideline for pollution prevention by U.S. EPA,

3. Identifying the causes of problems and possible prevention strategies by interviewing the focus group of 40 people from the environment and transport sectors in Thailand such as the Ministry of Natural Resources and Environment, Ministry of Transport, Police Department and Universities

4. Identifying the priority problem and 4 high-potential alternative solutions by Interviewing a focus group of 20 experts related to the environment and transport sectors and decision-making by using a multi-criteria analysis (AHP combined with Fuzzy techniques).

The interviewed 20 experts were from the Office of Natural Resources and Environmental Policy and Planning, Pollution Control Department, Office of Transport and Traffic Policy and Planning, Land Transport Department, Police Department and Universities,

5. Operating a transport model by using Extended Bangkok Urban Model: eBUM with transport program (CUBE Voyager) from OTP, Ministry of Transport. OTP has developed these tools and database since 1998 for all related agencies in order to provide them the same tools and database. In addition, the study was used the transport master plan and transport database from OTP Ministry of Transport,

6. Operating a vehicle emissions model by using the international vehicle emissions (IVE) model from U.S.EPA, and using Bangkok driving cycles for each type of motor vehicle in Bangkok from OTP and PCD. and

7. Presenting the outputs by using GIS software (ArcView) and base-map from OTP, Ministry of Transport, Thailand.

1.4 Hypotheses

1. Integration of pollution prevention techniques, transport and vehicle emission models can provide potential applications for prevention of air pollution from the transport sector as a part of a move toward sustainable development, and

2. Source reduction is a driving force or strategy tool for achieving prevention of high-risk air pollution

1.5 Expected Outcomes

1. An appropriate pollution prevention application and a hierarchical environment decision making framework on high-risk air pollution and human health,

2. A set of strategies with potential for achieving air pollution prevention in Bangkok urban area,

3. An algorithms considering the combination of transportation and air pollution prevention decision making in order to assist with regarding the outlook of the people to decide on the balance between the environmental and transportation aspects,

4. The best solutions or prevention strategies in order to minimize pollution to meet ambient air standards as a part of a move toward sustainable development, and

5. These applications can be used for analysis or evaluation in other specific areas beyond to the Bangkok urban area.