CHAPTER 1
INTRODUCTION

Throughout history, lead has been well known and commonly used by man. It was first mined over 5000 years ago and ancient civilizations of Phoenicia, Egypt, Greece, India, and China used the metal for vessels, roofs, waterducts, utensils, ornaments, and weights (Harte *et al.*, 1991). During the Roman Empire, its use achieved industrial proportions with its extensive use in the transport of water and the storage of wine and food.

To this day, lead is a common industrial metal with primary uses in automobile batteries, gasoline additives, and pigments and paints. Consequently, it has become widespread in air, water, soil, and even food. Cunningham *et al.* (1994) state that the widespread use of lead in gasoline, for one thing, poses a serious environmental problem. Due to its extensive use in industrialized society and its toxic properties, lead is monitored in various food and environmental samples, including biological samples, in order to assess health risks to humans and the environment, in general. At the same time, efforts have been done to reduce exposure from major pollution sources.

Over the past two decades, legislative action has been taken, mainly in industrialized countries, to enforce the widespread use of lead-free gasoline. Consequently, decreases in exposure from inhalation and ingestion of food contaminated by atmospheric lead deposition were reflected in declines of mean blood lead (PbB) levels observed in population studies as cited by Hense *et al.* (1992).

In Thailand, efforts to control vehicular lead (Pb) emissions and therefore, to reduce atmospheric Pb, were made with the reductions of the maximum allowable Pb in gasoline from 0.84 g/l to 0.45 g/l in 1984 and subsequent reductions to 0.15 g/l effective January 1992. Additionally, premium unleaded gasoline at prices below that of leaded gasoline was introduced in the market in May 1991 (Boontherawara *et al.*, 1994) and leaded gasoline was phased out in the market starting January 1996 (Wangwongwatana, 1996).

1.1 Statement of the Problem

Chiang Mai City (population: 167,945) (Population Institute, Chulalongkorn University, 1995) is the largest city in Northern Thailand. It has been, and still is, experiencing a rapid development. One result of such has been the fast-growing number of motor vehicles in the area. The number of vehicles has been increasing steadily over the past five years. The most recent statistics show an increase of about 11% from 448,799 vehicles in 1995 to 498,084 in 1996 (Chiang Mai City Land Transport Office, 1997; Traffic Registry Office, 1995).

This rapid urbanization has thus increased the volume of traffic in the city which could, in the long term, place certain groups of the population at risk. For one thing, the Pb content in gasoline has been considered one of the major anthropogenic Pb sources in the area and air pollution mainly from airborne Pb and dust has been a cause of public health concern. Kang (1996) studied the distribution of Pb in roadside dusts as well as air Pb levels in different sites in Chiang Mai City. Although the average Pb level in the city obtained from this study did not exceed the Air Quality Standard of Thailand (10 μg airborne Pb/m^3) and that of the U.S. Environmental Protection Agency (USEPA) (1.5 μg airborne Pb/m^3), an association with high traffic volume and Pb levels in certain sites in the city was presented. Furthermore, the mean air Pb level along roadsides in Chiang Mai City were at least three to five times higher than those of two control sites. Additionally, a determination of blood lead (PbB) among traffic policemen was included within the framework of a health examination project conducted in 1995 (Prapamontol *et al.*, 1996).

1.2 Significance of the Study

With the phase out of leaded gasoline in Thailand, a reduction in Pb contamination in the area is expected. However, it may be presumptuous to consider national or regional gasoline sales as enough predictors of possible human exposure. It is within these contexts that this study was conducted. That is, it is useful to determine the Pb level in blood of a population at risk -- in this case, traffic policemen -- who are the focus of this study.

1.3 Objectives of the Study

1.3.1 Primary Objective

A voltammetric method for Pb analysis in whole blood was developed and validated and subsequently applied for the main purpose of this study which was to investigate how much Pb do traffic policemen have in their blood due to exposure from vehicular Pb emissions.

1.3.2 Secondary Objectives

In conjunction with the determination of PbB levels, the secondary objectives were:

1. To examine the possible association between PbB levels of traffic policemen with non-occupational as well as work-related variables based on questionnaire data;

2. To determine which factors tend to increase the occurrence of PbB $\geq$10 μg/dl, the lowest-observed-effect level for lead-induced health effects in adults;

3. To compare the PbB levels of traffic policemen from a previous screening (1995) with those obtained in this study (1996).