CHAPTER I

INTRODUCTION

1.1 Background and Motivation

Zinc is a natural element which is an essential substance for both humans and the environment. It is needed for plant growth and human body mechanisms. Moreover, zinc ore and its compounds are used in many applications by human beings. They are used in anti-corrosion coating on steel, construction materials, as raw material for brass and bronze production, in pharmaceutical and cosmetic production, and as a component of fertilizer and food supplements. Therefore, zinc ore has been mined in order to support demand. In Thailand, the Zinc consumption rate from 1998 -2003 tended to increase severely, as Table 1.1 shows below. The main productions are zinc ingot and zinc alloy. A majority of product is for the domestic market.

Table 1.1 Zinc Productions and Consumption of Thailand 1998 – 2003.

Year	Zinc Production		Zinc Consumption	
	Quantity (Ton)	Value (million Bath)	Quantity (Ton)	Value (million Bath)
2003	148,297	965	91,871	3841
2002	151,876	947	85,037	3487
2001	88,664.	665	726,45	3392
2000	159,093	1393	73,966	3850
1999	185,752	1,475	63,51	2929
1998	195,122.	1,508	40,600	2,036

Source: Department of Primary Industries and Mines (2006).

Due to the increasing demands for zinc products, this leads to increasing of environment impacts, particularly trace heavy metal such as cadmium reached out from the processes. It is recognized that zinc mining and smelting are major sources of cadmium contamination. Cadmium is toxic not only to the environment but also to human health. Several countries in the world where zinc mines and smelting plants are located have been facing to this problem.

There is a zinc deposit at Doi Pha Deang, Phra Tat Pha Deang sub-district about 12 km from Mae Sot district, Tak province, northern Thailand. Mae Sot District has been heavily contaminated by cadmium. The elevated concentration of cadmium in cultivated soil and rice grain was investigated by the International Water Management Institute (IWMI) and Department of Agriculture (DOA) of Thailand in 2001-2003. The concentrations of total cadmium in soil samples were much higher as compared to the average of cadmium concentration found in the Thailand soil that determined by Pongsakul and Attajarusit (1999) which is in the ranges of < 0.01-0.141 mg/kg. Regarding to cadmium concentration in rice grain, more than 95 % of samples exceeded the Codex Committee on Food Additives and Contaminants provision maximum level for rice grain of 0.2 mg/kg.

Besides the IWMI and DOA study, both Ministry of Natural Resources and Environment (2004) and National Research Center for Environmental and Hazardous Waste Management (NRC-EHWM, 2004) did the research on distribution of cadmium concentrations in this area. Their results correspond to the study of IWMI and DOA that total cadmium was found at high concentrations in the floodplain area of Mae Toa. It was expected that zinc mining in this area is at least one of a major contributor to the cadmium contamination in the Mae Toa sub-catchment area. The study by NRC-EHWM (2004) divided the area of the Mae Moei River Basin into 7 sub-catchments (see Figure 1.1). The zinc mining activities are located in the Mae Toa sub-catchment. This leads to the conclusion that the cadmium distribution in the Mae Toa sub-catchment is mainly

contributed by the mining activities. Interestingly, the study also found that sediment samples collected from the Mae Ku, a nearby sub-catchment, was also relatively high.

Unfortunately, the existing study of cadmium distribution at the Mae Ku sub-catchment contained a limited amount of data. Even though this area has a significant potential for cadmium contamination due to some parts of zinc mine boundary, including the waste mine tailings dumping site, falling within this area. Furthermore, in the past, heavy rain in this area has led to flooding. Tailings containing cadmium is believed to be transported from upstream areas to the floodplain area in Mae Ku. In order to obtain more information on cadmium distribution in Mae Ku sub-catchment as well as to investigate the major source of contamination, which will lead to appropriate mitigation measures and assist in the preparation of plans to solve the problem.

1.2 Objectives

1. To investigate the distribution of cadmium and zinc in soils along the Mae Ku floodplain, Mae Sot district, Tak province.
2. To correlate the total concentration of cadmium and zinc in study soils
3. To study the relationship of the bioavailability of cadmium and zinc by the sequential extraction procedure.

1.3 Hypothesis

1. Mae Ku watershed has the potential for cadmium contamination. The cause of the contamination may be from the zinc deposit or mineral processing activities situated in this sub-catchment.
2. The ratio of total and bioavailability cadmium and zinc concentrations from the Mae Ku watershed is expected to indicate the contamination sources and how cadmium is transported to the Mae Ku floodplain.

1.4 Scope of the Study

This research investigates cadmium contamination in soil from the Mae Ku watershed, Mae Ku sub-district, Mae Sot district, Tak province. The scope of study is as follows:

1. The study area covers the floodplain area in Mae Ku watershed, sub-district Mae Ku, Mae Sot district, Tak province. The total study area is about 2.5 Km. x 2.25 Km.
2. Soil samples were collected from the floodplain in this area by a grid system.
3. The concentrations of total cadmium and zinc in soil samples and concentration of cadmium and zinc in bio-availability form in soil were determined using Atomic Absorption Spectroscopy (AAS) or Inductive Coupled Plasma Spectroscopy (ICP).
4. The results were analyzed to determine the relationship of the concentrations of cadmium and zinc in soil of the Mae Ku watershed.

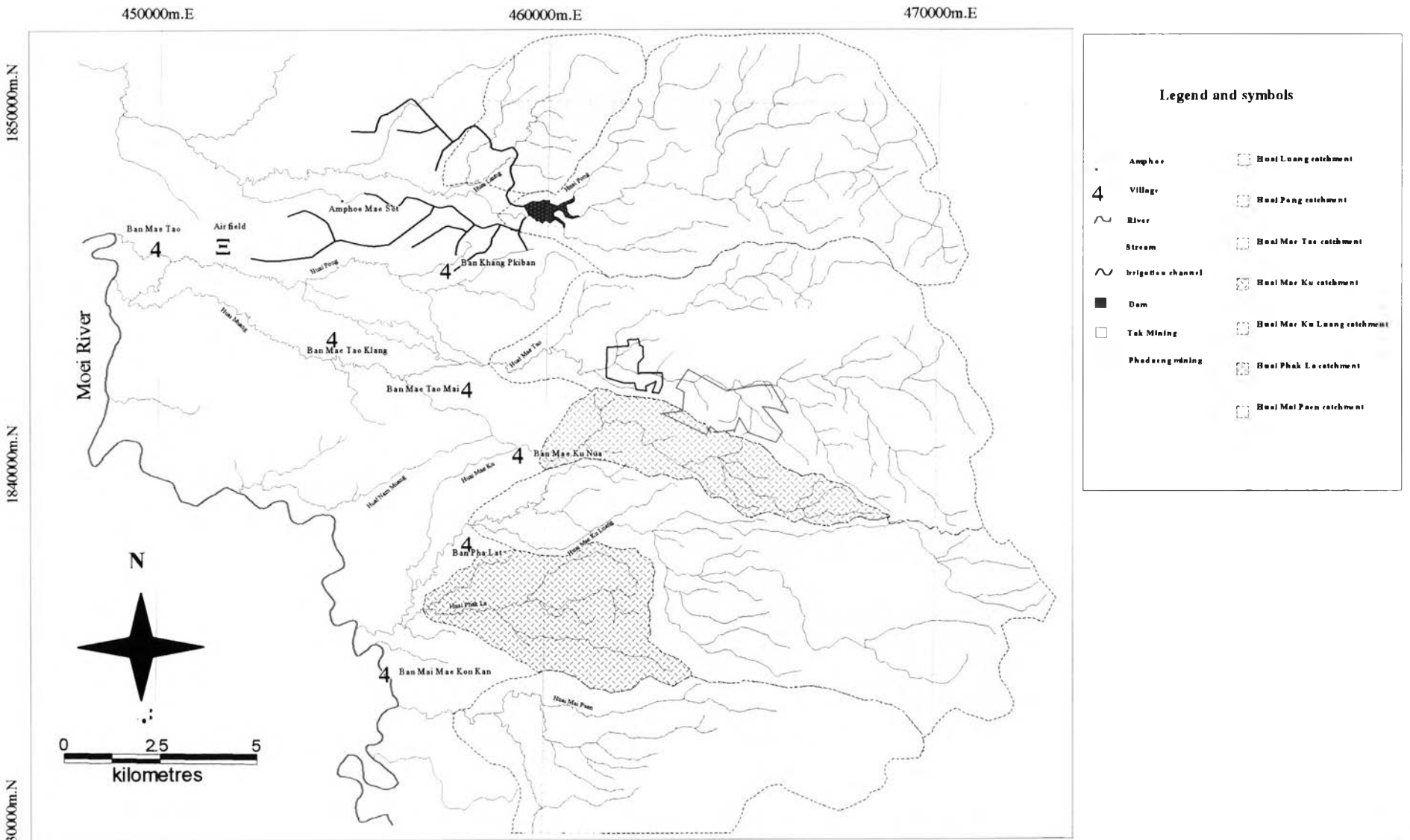

Figure 1.1 Sub – Catchments in Mae Moei River Basin

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