Chapter 1

INTRODUCTION

1.1. INTRODUCTION

World energy production is dominated by all types of fossil fuels, of which coal is predicted to soon become the major source of fossil energy (Fyfe *et al.*, 1993). Coal is also used as primary energy to generate another form of cleaner energy *i.e.* electricity. Energy production causes vast environmental changes due to products released into the environment during emission processes, such as heat, carbon dioxide (CO_2), sulfur dioxide (SO_2), and nitrogen oxides (NOx). These changes should be considered by man to maximize the positive effects, *i.e.* energy and minimize the negative effects, *i.e.* pollution.

World energy demand increased by 50 percent from 1970 to 1990 with a predicted 50 percent increase from 1980 to 2000. Coal will contribute to 33 percent of total world energy needs (Fyfe *et al.*, 1993). At present, 40 percent of the world's coal production is used for electricity generation (Williams *et al.*, 1994).

Thailand is similar to many other countries in its economic development, since the demand for energy has increased enormously and continuously. Electricity generally takes about 20 percent of all public investments (Bounkrop, 1996). Energy consumption in Thailand is mostly dominated by fossil fuels, of which coal/lignite have contributed about 22 percent of total fossil fuels used. Coal and lignite used in Thai power stations will reach 66 percent in 2006 (Thailand National Report, 1992).

By using indigenous lignite, the country can be more self-reliant in energy supply and save much money by reducing oil imports which greatly improves the national economy (EGAT, 1994).

In contrast, coal/lignite mining and burning also creates a great threat by changing the world's environment. About 75 percent of man-made air pollution is caused by energy utilization. Sixty percent of the energy content of coal is added to the environment as heat near power plants while some is directly added to the atmosphere by smoke stacks and much to water bodies which are used cooling water (Leopold and Almanac, 1976).

Surface coal mining industries require large-scale land use for overburden removal and disposal. This causes disturbances of local hydrology and runoff, scenic degradation, tremendous amounts of dust, noise, soil erosion, transportation problems, and ecosystem disturbance. Surface water runoff dissolves mineral substances from the soil and rocks in the overburden. Stockpiles can act as ground water pollution sources when rainfall percolates through the stored material, dissolving pollutants and transporting them to ground water systems (Sendlein *et al.*, 1983).

Coal combustion in power stations causes considerable air pollution, which includes SO_X, NOx, and CO_2. Consequently, coal burning has now become one of the most damaging of all sources of world environmental pollution. Of the gases which are thought to produce the "green house effect", carbon dioxide is the most important and is responsible for over half the total damage to the atmosphere (Chatterji, 1981).

In Thailand, lignite deposits have been found in 37 basins in the northern and southern provinces. Present proven reserves are about 1,100 million tons, of which over 80 percent are located in the north. Recently, large lignite deposits have been found in Songkhla and Suratthani Provinces. Utilization of lignite in industry has been actively promoted (Bounkrop, 1996).

Mae Moh Mine is a lignite deposit that is located in Mae Moh District, Lampang Province. Lignite was discovered there in 1917 and has been used as a source of fuel for the power plant at Mae Moh since 1956. Expansion of the Mae Moh Mine and Power Plant was approved by the government in 1972 and 1978 and is operated by the Electricity Generating Authority of Thailand (EGAT). Presently, there are 13 generating units which are estimated to consume approximately 42,800 tons of lignite a day. Every day about 256,800 tons of mine waste and 12,840 tons of power plant waste are disposed there (EGAT, 1994).

1.2 RATIONALE AND HYPOTHESIS

The activities of Mae Moh Mine and Power Plant have produced large amounts of waste materials, such as overburden and ash, which also contain trace elements. When precipitation passes through the waste dumps, it reacts chemically and biologically with these waste materials. Leaching and other processes result in the addition of contaminants to the water column. These leachates escape from the waste dumps into both surface and ground water systems and have significantly degraded their quality.

According to this rationale,

1. Surface and ground water at the Mae Moh Mine and Power Plant area should be contaminated by heavy metals released from mining and power plant operations, and

2. The concentrations of heavy metals in surface and ground water vary seasonally while underground water contamination depends on the depth of the ground water.

1.3. PURPOSE OF THIS STUDY

1. To monitor the amount of heavy metals in surface water and ground water.

2. To assess potential risks for heavy metal contamination in surface and ground water.

1.4. RESAERCH PERIOD

Selected study sites at Mae Moh were visited monthly from July to December 1998.