Chapter I

Introduction

1.1 Rationale of the Study

According to the 7th National Economic and Social Development Plan period (1992-1996) policy which supports the use of the domestic energy sources, the demand of electricity consumption will increase approximately from 10,000 MW in 1994 to 24,900 MW by the year 2006. Then lignite will be one of the major source of raw materials needed to generate such high demanding electricity. The use of lignite will be approximately increase from 12,288,156 tons per year in 1994 to 36,000,000 tons by the year 2006. Despite the burning of lignite emits various types of air pollutants. The pollution will be affected both in the vicinity nearby the source and the farther area. It depends on the distribution and transformation of such air polluted compounds from their sources.

Mae Moh Power Plant is the second large power source generating about 25 percent base load energy of the total supply in Thailand. It is located in Mae Moh District, Lampang Province, approximately 650 kilometers north of Bangkok. It is about 26 kilometers east of Lampang provincial town. Currently equipped with 13 generating units with the combined capacity of 2,625 MW, this power plant is fueled by indigenous lignite available in the nearby Mae Moh Basin. The consumption of lignite at Mae Moh Power Plant totals 42,800 tons per day. Of this amount, 4,400 tons are supplied to Units 1-3; 3,300 tons to each of Units 4-7 and 6,300 tons to each of Units 8-11 which consume the same amount as Units 12-13.

Electricity generated by this method or by the combustion process, cause formation of air pollutants which then are released into the atmosphere. Some of these pollutants are particulate matter, oxides of sulfur, oxides of nitrogen, hydrocarbon and carbon monoxide are released directly from the manufacturing processes called primary air pollutant. In particular, sulfur dioxide is the major air pollutant released from this Power Plant. The continuous measurement and monitoring of these pollutants were done for the control of SO_2 and other above mentioned primary air pollutants. However, damage in the nearby SO_2 area may not be caused by sulfur dioxide alone. In spite of non-relationship between damaged properties and health problems that occurred in this area while low sulfur dioxide was measured at that time (SO_2 concentration not exceeding the ambient standard). Therefore, it is possible that these incidents of damaged properties and health problems were brought on by other air pollutants or pollutants rather than SO_2 alone. This is a very interesting assumption which, the author feels, besides SO_2, should be studied and analyzed. Some of these air pollutants are sulfur containing compounds such as sulfate aerosol which has a potentiality for damaging health and properties due to its acidity.

During the wet season (April - October) when the moisture-laden winds of the monsoon dominate the weather pattern of much of Southeast Asia and the Indian subcontinent, the SO_2 and NO_x emitted in localized areas (along with the sulfates and nitrates produced from these compounds) would likely be carried farther from their source than in the winter. According to the resident time of the aqueous-phase products of SO_2 and NO_x is greater than the corresponding gas-phase reaction products, allows the predominant south-southwest winds during this period to carry most of the acidic substances to be wet deposited in areas north-northeast-northwest of the original emission sources.

In addition, during the dry season (November - March) the transport pattern of these acidic pollutants and their precursors are completely different. Most of Asia continental areas are in the dry season, except the southeastern and parts of the eastern portions. The gaseous-phase reactions and dry deposition dominate during this period. Since the dry deposition processes usually occur near the source of emission than wet deposition, the transport distances could be reduced. In addition, Mae Moh is a basin and wind speed during these months is low, coupled with the prevalence of north-northeast-northwest wind causes fumigation which introduces more transformation reaction of SO_2 in this area.

1.2 Hypothesis of the Study

1. Harmful effects in the vicinity of sulfur dioxide source are caused by sulfate aerosol.
2. Concentration of sulfur dioxide , sulfate aerosol and sulfate aerosol acidity in the vicinity of Mae Moh Power Plant have the relationship with period of the day , solar radiation , ozone concentration , catalysts concentration and wind direction different.

1.3 Objectives of the Study

1. To investigate the quantities of sulfur dioxide (SO_2) , sulfate (SO_4^{2-}) and acidity of sulfate aerosol during daytime and nighttime period.
2. To investigate the relationship of sulfur dioxide (SO_2) , sulfate (SO_4^{2-}) and acidity of sulfate aerosol in the area that nearby sulfur dioxide source.
3. To study phase of an acid aerosol and the mechanisms of sulfur dioxide (SO_2) transformation in the vicinity of Mae Moh Power Plant.

1.4 Scopes of the Study

The scopes of this study are as follows:

1.4.1 To investigate the quantities of sulfur dioxide (SO_2) , sulfate (SO_4^{2-}) and acidity of sulfate aerosol during daytime and nighttime period.

1.4.2 To evaluate potential of the acidity of sulfate aerosol which will be used for verify that sulfate aerosol is one of air pollutants that caused harmful effects in the area that nearby sulfur dioxide source.

1.4.3 To study the relationship of parameters that involved in the formation and concentration of sulfate aerosol. The parameters to be studied are

- sulfate concentration
- aerosol acidity (H^+ as H_2SO_4)
- sulfur dioxide concentration
- ammonia concentration
- ozone concentration
- catalysts concentration (Fe , Mn , V)
- solar radiation
- meteorological conditions (wind speed, wind direction)

All of parameters which studied will be compared which the variable parameters as below:

- daytime and nighttime period
- upwind and downwind from the source

1.5 Anticipated Benefits

The study of sulfate aerosol and its acidity nearby sulfur dioxide source in the vicinity of Mae Moh power plant, Lampang province have the expected uses as follow:

1. To estimate the effect from wind direction and period of the day to sulfur dioxide concentration, sulfate aerosol concentration and sulfate aerosol acidity.
2. Evaluate the potential damaged in the area by considered not only sulfur dioxide concentration but also sulfate aerosol acidity.
3. This will be the case study of the relationship between sulfur dioxide and sulfate aerosol in the vicinity of sulfur dioxide source which can be used for the database using for the obvious evaluation of the environmental impact assessment of sulfur containing compounds.
4. To give benefits in considering and studying of the transformation and the deposition of sulfur dioxide in the nearby source area.