CHAPTER VI

CONCLUSIONS AND RECOMMENDATION

6.1 Conclusion

In this study, Monte-Carlo technique and the Guassian air dispersion model, the ISCST3 model are employed to simulate the 24-hour average concentration of ambient PM_{10} released from 48 stone-processing plants in Na Pra Laan and vicinity in Saraburi Province . The annual trend of the 24-hour average concentration and their statistical values at 5 receptors are investigated under the assumption of an 80% across-the-board reduction of the plant emission rates after the introduction of dust control systems. The major finding are be summarized as follows:

1) By making use of the graphical probability plot of the meteorological data, it is found that the gamma distribution is the best probability distribution to describe the nature of all the past meteorological data (wind direction, wind speed, cloudiness, mixing height, and ambient temperature).
2) As shown in Figure 5.10, the statistical characteristics of the key meteorological inputs of the study area are found that the highest overall probability of wind direction falls in the wind sector of 135^{o} - 180^{o}, for wind speeds below 1.5 and about 2 m/s. In all direction sectors, the wind speed falls in the range of calm wind (0 - 2 m/s) at least 75% of the time and is slower than 1.5 m/s at least 50% of the time.

3) When uncertain meteorological inputs were used, one can see that daily value and the magnitude of annual variation of the 50-year mean of 24-hour PM_{10} at Receptor # 1 is very small compared to that at Receptor # 4, which clearly has much higher mean values on most days and a large variation of the mean values. This is mainly because Receptor # 4 is located downwind of the predominant wind direction, while Receptor # 1 is located upwind of Receptor # 4. In addition, Receptor # 1 is located at an elevated level on the rearside of a high hill which shields it from the PM_{10} emitted by the plants located upwind. In other words, the prevailing southeastern wind plays an important role on the expected (or mean) value of PM_{10} over the northwestern region.
4) On the other hand, at Receptor # 3 the annual trend of the expected value of the 24-hour PM_{10} appears to be significantly lower from early March to late September than during in the other months of the year. This confirms that the prevailing northeastern wind during the winter (October – February) considerably increases the expected PM_{10} value over the southwestern region.
5) The magnitude of daily fluctuation in the expected value of the PM_{10} is generally much smaller than that of the daily maximum or the daily sample standard deviation. The reason may be attributed to the interactions between the stochastic or random inputs (wind speed, wind direction, etc.) used in the simulations.
6) The location of a receptor or monitoring station must be made with care and based upon preliminary investigation or simulation results. For example, Figure 5.12 reveals that the probability of the 24-hour PM_{10} exceeding the ambient standard value regulated by PCD (120 $\mu g/m^3$) is essentially nil at Receptor # 5 throughout

the year. So is the probability at Receptor # 5 except the months of August and September, during which the probability of exceedance is extremely low, though not zero. On the contrary, at Receptor # 4 the probability of exceedance would be higher than 50% of the whole year even after the implementation of dust suppression systems to reduce the emission rate of each plant by 80%. The detailed simulation results show that the ambient standard value is exceeded on 9,315 days out of the total of 18,250 days.

7) When uncertain emission inputs were used, it is found that Receptor # 1 has small expected values of the 24-hour average concentration because of its location and prevailing wind direction. For similar reasons, the expected values of the 24-hour average concentration at Receptor # 3 increase significantly during the winter months (October – December). However, expected values at both receptors rarely exceed the ambient standard value of 120 $\mu g/m^3$.

8) At Receptor # 4, large expected values are seen in the annual trend of the 24-hour average concentration during August – September because of the high frequency of southwest wind direction and because several stone-crushing plants are located upwind.

9) When comparing the cases of random meteorological inputs and random emission rate inputs, obviously, the magnitude of uncertainty in the 24-hour PM_{10} in the latter case is very small despite a relatively large standard deviation of 10%. Therefore, it may be concluded that uncertainty in the meteorological inputs has more significant effect on PM_{10} uncertainty than that in the emission rate inputs.

10) On annual basis (365 days), the frequencies of exceedance of the ambient standard concentration value obtained from using meteorological input and emission input, they are 186 and 164, respectively.

11) The degree of autocorrelation in the wind direction has more effect on the behavior of the PM_{10} concentration than that of the wind speed because of the attribution to the calm wind condition of the wind speed input in the study area (wind speed < 2.0 m/s)

6.2 Recommendation for future study

In any air dispersion modeling, input data and parameters as well as the simplifying assumptions used in the model should be selected carefully and rationally. Due to the shortage of reliable meteorological and accurate emission rate data in this study, the author recommends following in a future study:

1) Stone-processing equipment, stockpile and open areas are should be modeled as area sources, not point sources.
2) The actual emission rates of each piece of processing equipment should be investigated in advance.
3) The effect of degree of autocorrelation in the meteorological inputs on the level of uncertainty in the outputs should also be investigated.