CHAPTER 8

CONCLUSION AND RECOMMENDATION

8.1 Conclusion

In the investigation on the suitability of the advection diffusion model for air pollutant dispersion over non-planar terrain, it can be concluded as follows:

1. In comparison with the analytical transport phenomena model for flat terrain, it is shown that the model is in practice useful for use to predict the atmospheric dispersion of air pollutant over a wide area (long distance downwind) rather than near a point source.
2. In comparison with the wind-tunnel experiments over non-planar terrain, the model is more suitable to predict the downwind concentration at the front slope of the hill than the back slope of the hill and is more accurate when the terrain has less difference in height.

Computer experiments are carried out on the model to investigate the effect of significant factors is studied as follows:

3. With respect to the dispersion of SF_6 from a single point source over an isolated hill modeled after Steptoe Butte hill, Washington State, the factors more or less significantly influencing the predicted 45-min. average concentrations at various receptors are as follows:

    3.1) The wind direction generally shows a significant effect on the predicted 45-min. average concentrations at those receptors located downwind. The wind direction indicates whether the wind flows toward to a particular receptor or not

and whether the receptor lies beyond the reach of the dispersed plume.

3.2) The wind speed shows a positive effect on the predicted 45-min. average concentration when the receptor is located near the path of the plume. On the contrary the wind speed shows a negative effect on the concentration at a receptor located far from the path of the plume because the plume angle decreases as the wind speed increases.

3.3) It is found that the horizontal dispersion coefficient causes a slightly negative effect at a receptor located close to the path of the plume and a positive effect when a receptor is located far from the path of the plume. However, at a receptor located far from the path of the plume, the change in the horizontal dispersion coefficient exerts a greater influence on the predicted 45-min. average concentration than a case in which the path of the plume is close to the receptor.

3.4) The vertical dispersion coefficient has a significant negative effect on the predicted concentration at all receptors. This effect is greater when a receptor is located beyond the envelope of the dispersed plume under high wind speed condition.

3.5) As the exponent of the power law increases, the predicted average concentration at most receptors generally increases, especially when the receptor is located near the path of the dispersed plume because of the curving effect on the flat profile of wind.

Finally, the model is applied to predict the concentration of PM_{10} over the stone-processing zone in Saraburi area as follows.

4. The ambient of PM_{10} concentration at selected receptors located in the stone processing zone in Saraburi Province is predicted for

various wind directions, wind speeds and vertical dispersion coefficients. The major findings can be summarized as follows:

4.1) As reflected in a decrease in vertical dispersion coefficient, an increase in the stability of the atmospheric condition increases the predicted average PM_{10} concentration observed at all receptors.

4.2) At receptor P1, when the wind direction is in the range of 45-59 degrees and the wind speed is high, the predicted average PM_{10} concentration is high.

4.3) The highest predicted average PM_{10} concentration at receptor P2 occurs when the wind speed is low and the wind direction is larger than 59 degrees with the south, or 239 degrees from the north. In fact, the predicted average PM_{10} concentration at receptor P2 slightly exceeds the air quality standard of Thailand (120 $\mu g/m^3$) at the wind speed less than 1 m/s and the wind direction greater than 29 degrees.

4.4) The hightest predicted averaged PM_{10} concentration at receptor P3 occurs predominantly when the wind direction lies between the west and the northwest (of -1 degrees or less). Within the direction, increasing the wind speed increases the predicted PM_{10} concentration. Generally, the predicted average PM10 concentration at receptor P3 is quite higher than the air quality standard of Thailand (24-hour-average of 120 $\mu g/m^3$) because it is located near a cluster of the stone processing plants.

4.5) Because of the mostly calm wind condition ($\leq$ 2m/s) in Saraburi Province, the wind direction exhibits a significant effect on the predicted PM_{10} concentration at the majority of the receptors except at receptor P4. A shift in the wind

direction does not cause a manifest difference in the averaged PM_{10} concentration at P4 .

4.6) The emission rate factor produces proportional effect on the predicted average concentration.

4.7) In this computer experiment, the type of downwind boundary conditions has insignificant effect on the simulation results.

8.2 Recommendation

The present model is reliable only in some cases under atmospheric conditions. 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 the following issues of future study:

1) Modification of the model should be extended to more accurately handle other atmospheric stability conditions by incorporating the turbulence effect in the model.
2) Smaller grid size should be adopted to reduce the computational error.
3) The actual emission rates of each piece of processing equipment should be investigated in advance.