

M.S.67. ANILKUMAR—Studies on the Meteorological Aspects of Air Pollution Over Cochin—1986—Dr. D.V. Viswanathan

Pollutants that once enter into the earth's atmosphere become part of the atmosphere and hence their dispersion, dilution, direction of transportation etc. are governed by the meteorological conditions. The Thesis deals with the study of the atmospheric dispersion capacity, wind climatology, atmospheric stability, pollutant distribution by means of a model and the suggestions for a comprehensive planning for the industrially developing city, Cochin.

The definition, sources, types and effects of air pollution have been dealt with briefly. The influence of various meteorological parameters such as vector wind, temperature and its vertical structure and atmospheric stability in relation to pollutant dispersal have been studied. The importance of inversions, mixing heights, ventilation coefficients were brought out. The spatial variation of mixing heights studies for the first time on a microscale region, serves to delineate the

regions of good and poor dispersal capacity. A study of wind direction fluctuation, and its relation to stability and mixing heights were shown to be much useful. It was shown that there is a necessity to look into the method of computation of the development of Gaussian Plume Model along with the application for multiple sources was presented. The pollutant chosen was sulphur dioxide and industrial sources alone were considered.

The percentage frequency of occurrence of inversions and isothermals are found to be low in all months during the year. The spatial variation of mixing heights revealed that a single mixing height cannot be taken as a representative for the whole city because of its wide spatial variations. The southern portions of the city have low mixing heights and monsoonal months showed lowest mixing heights. The study of ventilation co-efficients showed values less than the required optimum value $6000 \text{ m}^2/5$. However, the low values may be due to the consideration of surface wind alone instead of the vertically averaged wind.

Relatively more calm conditions and light winds during night and strong winds during day time were observed. During most of the year westerlies during day time and northeasterlies during night time are the dominant winds.

Unstable conditions with high values of σ_z during day time and stable conditions with lower values of σ_z during night time are the prominent features. Monsoonal months showed neutral stability for most of the time. A study of Pasquill Stability category has revealed the difficulty in giving a unique value of σ_z for each stability category. For the first time regression equations have been developed relating mixing heights and σ_z . A closer examination of σ_z revealed that half of the range of wind direction fluctuations is to be taken, instead of one by sixth, to compute σ_z .

The spatial distribution of SO_2 showed a more or less uniform distribution with a slight intrusion towards south. Winter months showed low concentrations contrary to the expectations. The variations of the concentration is found to be influenced more by the mixing height and the stack height rather than wind speed. In the densely populated areas the concentration is more than the threshold limit value. However, the values reported appear to be high, because no depletion of the material is assumed through dry or wet depositions and also because of the inclusion of calm conditions with a very light wind speed.

A reduction of emission during night time with a consequent rise during day time would bring down the levels of pollution. The probable locations for the new industries could be the extreme southeast parts because the concentration towards the north falls off very quickly resulting low concentrations. In such a case pollutant spread would be towards south and west, thus keeping the city interior relatively free from pollution. A more detailed examination of the pollutant spread by means of models that would take the dry and wet depositions may be necessary. Nevertheless, the present model serves to give the trend of the distribution of pollutant concentration with which one can suggest the optimum locations for the new industries.