

Monitoring and Prediction of Fugitive Dust Concentration in an Opencast Coal Project Using AERMOD

[Dr. D.P. Tripathy]

Abstract— This paper focuses on the real time monitoring of dust level at different sources of a mechanised coal mine using DustTrak II and finally prediction of dust concentration at different locations of the mine and nearby areas using AERMOD view software. The paper summarizes the findings of dust measurement at different work places in different size range and using meteorological data and AERMOD software dust concentration around the mine were predicted. The predicted value of dust concentrations (PM10) were compared with NAAQS-2009 standard.

Keywords— fugitive dust, coal mine, dusttrak II, AERMOD

I. Introduction

Dust generation and its dispersion has been the major concern in large opencast coal projects. Airborne dust below 10 micron size can result in significant health risk to miners. Monitoring fugitive dust concentrations from different sources is essential in opencast coal mines and can be done using DustTrak II. Air dispersion models predict the ambient air concentrations of a compound at specific spatial locations (called receptors) using mathematical equations

Materials and Methods

A. Study area

The study area (Lakhanpur OCP) is situated in Jharsuguda district in Orissa.

The mine was divided into 3 quarries, i.e. quarry1 to quarry 3. The total mines area was about 4.84 km². In this area as mining operation is the main activity, dust pollution is the dominating factor for air pollution

B. Dust Measurement and Dispersion Modelling

The dust concentration was monitored by using an instrument DustTrakII. Dispersion modelling is a modern tool for prediction of pollution concentration at different locations within or surrounding the mining area. In this study AERMOD software was used for prediction of dust dispersion.

II. Results and discussion

A. Dust Monitoring

Monitoring was done by DustTrak II at nearly 9 locations. The results show that at all the operational points the dust concentration was very high. The drilling accounts for maximum values of dust concentration. The blasting point and loading-unloading point shows somehow high operation so to collect values for all size of particles with the instrument is not possible. For concentrations of dust during operation and the average concentration were comparatively lower in those areas. As blasting is an instantaneous that reason only monitoring was done for 10µm only.

B. Meteorological analysis of the area

Meteorological data was collected from the nearby weather station. AERMET file which was used as an input file in the AERMOD. Cloud Cover (tenths), Dry Bulb

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Temp (°C), Relative Humidity (%), Station Pressure (mbar), Wind Direction (deg), Wind Speed (m/s), Ceiling Height (m), Hourly Precipitation (1/100 th of inch), Global Horizontal Radiation (Wh/m²) were taken as meteorological parameter for the study. Wind rose plot is shown in Fig.1. The result shows that 34.17% time wind was in calm condition.

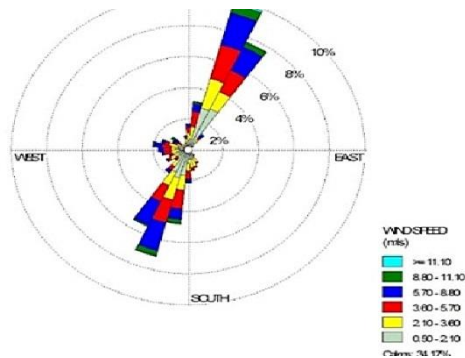


Figure 1: Wind rose

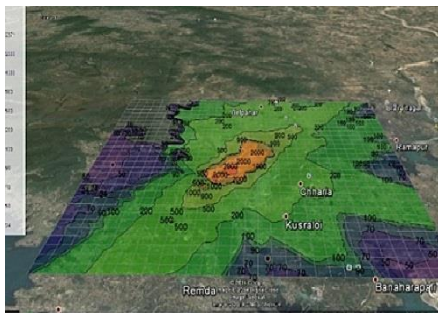


Figure 2: Highest 24 hour dust concentration Isopleths as seen in Google earth

c. Modelling by using AERMOD software

The prediction was done for about 30 different locations for both 24 hour average and annual average value, present near to the mine. The values from the table shows that at some locations like Tringismal, Khuntmahul, Karlajori, Khairkuni the values are far above the standard level for both 24 hour and annual data.

The modelling pictures gives the ideas of dust concentration at different location around mine. The model also obtained by incorporation of google earth for 24 hour maximum value and annual average value. Figure 2 shows the 24 hour maximum value on google earth map, indicating direct concentration level at specific sources.

III. Conclusion

The data from above field monitoring of dust concentrations using DustTrak-II at LOCP, it can be suggested that the maximum dust concentration was obtained at drilling point with average concentration of 26.8 mg/m³ and maximum concentration of 150.000mg/m³ in PM₁₀ range. Minimum mean dust concentration was found at loading point at 0.474mg/m³ for ≤ PM₁₀. For 24hr period, dust concentration for PM₁₀ at all other places except at Bartap, Adhapara, Lakhanpur, Mauliberena, Charla, Sarandamal, Dalgaon, Negipali, Kirarama, Katapali, Kudopali and Baliput, were found to be above NAAQS limit of 60 µg/m³.

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