Spatio Temporal Variation of Air Pollutants in the North East Coalfield areas under Indian Coal Mines

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Abstract

This is a part of the project which developed an Information & Communication Technology based software application tool focused and addressing the issues related with the preparation of Environmental Monitoring Report and Environmental Management Plan in North-Eastern Coalfields under Coal India Limited. It addressed mine water treatment with cost analysis, Overburden Dump Management along with the parameters of Air, Water, Effluent Water, and Soil. This user friendly software tool enabled with GIS or Geographical Information System.

The present paper dealt with the air pollution and its variations in a spatio-temporal scenario. In a highly vegetation domain which covered not only by forests but also wild life and tea gardens, air pollution played a pivotal role in maintaining the ecological balance, specially for micro organisms. Therefore the work opened a broad scope of research from air pollution to micro organism balance in an eco sensitive region.

Keywords: Pollution, GIS or Geographical Information System, OB or Over Burden, OCP or Open Cast Project

INTRODUCTION

North Eastern Coalfields situated in upper Assam's Tinsukia district, bordering Arunachal Pradesh. The coal extraction started from 1880s to serve the Railways. Underground and angular mining methods were practiced at that time. The whole area was thickly forested and lies between Patkai Hills and Dihing river. The scale of mining increased during the last three decades and the impact on the natural and human environment had begun. First, the high amount of sulphur which is the main characteristic of this tertiary coal gave birth to high AMD / Acid Mine Drainage which disturbed the whole water environment and Dihing river water. Second, when OCP or Open Cast Projects started functioning, mega scale air pollutants started to spread over the whole region. So, the OCP gave birth to twin environmental problems both of which stand against opposite to the ecological balance of an ecologically sensitive area.

On the one hand, there is a high demand for this coal in other industries and on the other hand a large scale employment and income generating activities are the backbone of the local economy. The far away remotest area generated employment and peripheral income generating activities based on this coal mining. Apart from coal though there is large tea gardens, especially Tata's amalgamated tea gardens, but scale of employment and subsidiary activities are much less than the coal mining.

MATERIALS AND METHOD

The air environment consists of meteorological parameters (wind direction, wind speed, temperature gradients, atmospheric stability and daily rainfall) and air quality parameters

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(gaseous and particulate matters). The meteorological parameters influence the transport and dispersion of the air quality parameters in the atmosphere.
Therefore air pollutant sampling and testing has been done in pre-monsoon and post-monsoon phases. April-May-June average and September-November average values were taken for analysis and thought. Other factors such as wind direction and hydro meteorological studies also have been done to chalk out the scope of work for pollutants' precipitation and deposition in agro-vegetative zones.

RESULTS

Hydro meteorological status vis-à-vis Climatic Condition of the Study Area:

The Climatic condition of the study area is governed mainly by the monsoon. Based on monsoon the study area can be divided into four seasons.

Temperature: Day & night temperature in the study area varies throughout the season. The maximum temperature in the study period recorded in the month of April (34°C) where on the lowest temperature recorded in the month of February (9.8°C). The Average maximum temperature in the study period is highest in April (29.06°C) and lowest in the month of February (26°C). The highest average minimum temperature also recorded in the month of April (19.5°C) and lowest in the month of February (12.9°C) as shown in Figure 1.

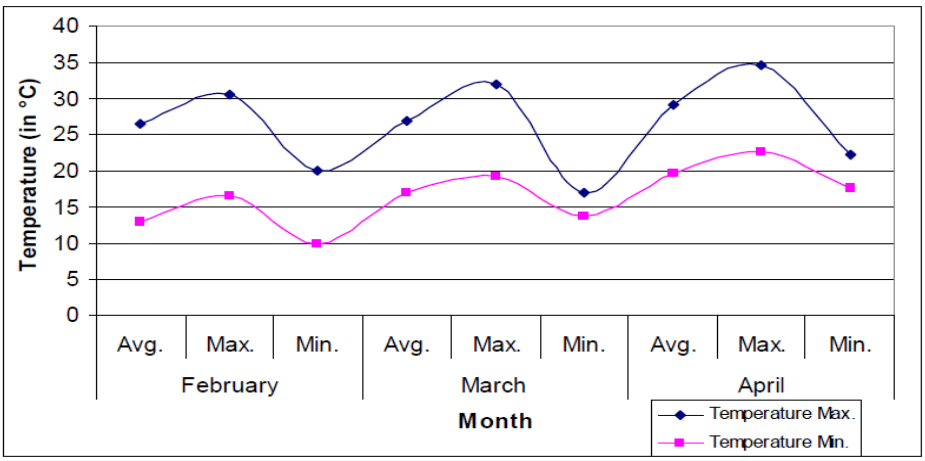

Figure 1.The graphical representation of the temperature during the study:

Humidity: Morning & evening percentage of humidity in the study area varies throughout the season. The highest humidity in the study period recorded in the month of March (98%) where on the lowest humidity also recorded in the month of March (38%). The Average humidity in the morning period in the study period is highest in April (76%) and lowest in the month of February (71.35%). Highest average evening humidity also recorded in the month of April (73.27%) and lowest in the month of February (61.78%) as shown in Figure 2.

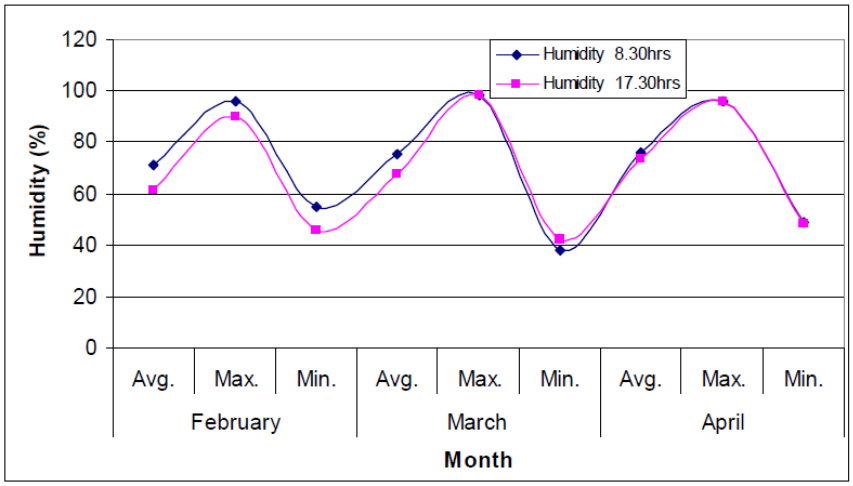

Figure 2.The graphical representation of the humidity

Rainfall: Northeastern part of India received highest amount of rainfall then rest of the country. The state of Assam is also not different from it. The study area also received a good amount of rainfall thought the data has been collected during the pre-monsoon season. March (261.5mm) month received highest amount of rainfall where on the lowest amount of rainfall occur in the month of February (14.4mm) as shown Figure 3.

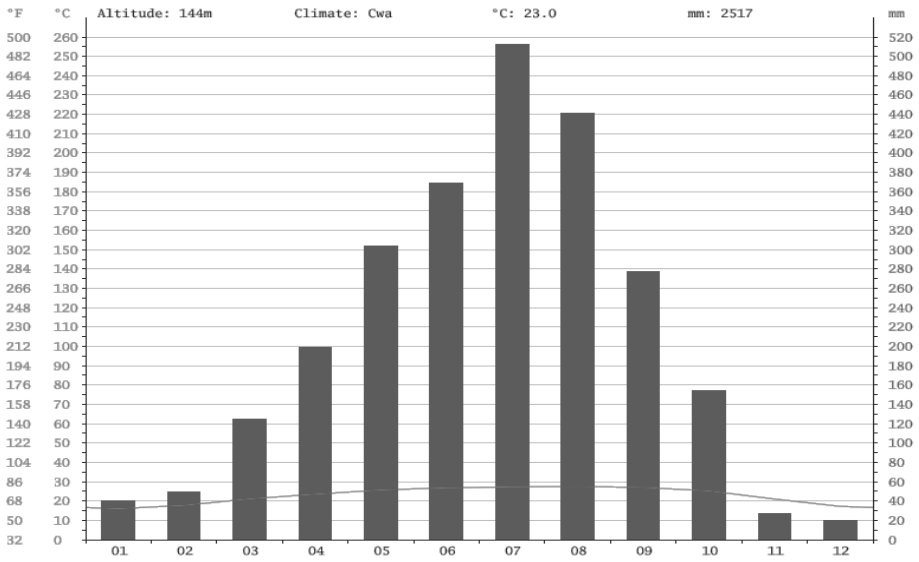

Figure3. Climate graph

Wind Pattern: Wind pattern in the study area has been recorded during the three months period on hourly basis. A windrose has been prepared based on the recorded data. Wind class frequency shows that maximum wind blow with velocity in between 2.1-3.6m/s as shown in Figure 4.

Discussions

Three mine areas and nearby habitation areas air quality shows that, though all are within the limit regarding Government notification, but both PM 2.5 and PM 10 as shown in Table 1 are alarming in mine areas and nearby habitation areas. The difference between

these areas may be two to three times higher or less as we may consider, but in the long run the impact on human health, especially lung and chest diseases will be negative. Continuous deposition on the tea garden and agricultural fields may change the microbial activities in soil ecological balance and productivity. This may be taken as first information or diagnosis report for studies on above two aspects.

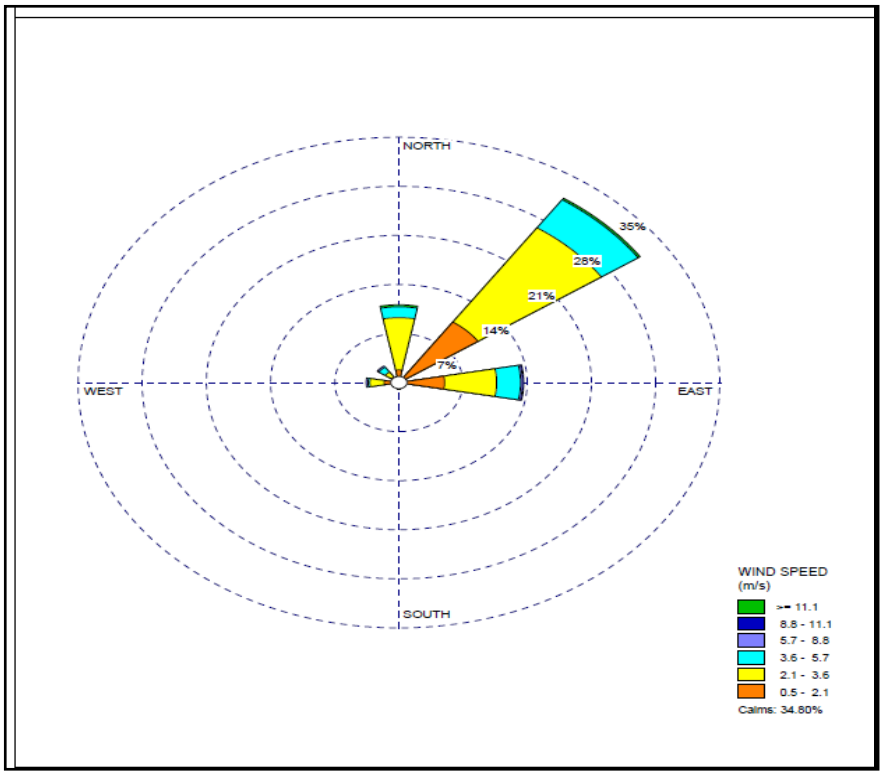

Figure 4. Windrose

Table 1. Air Pollutants Test Results:

Locations	**PM 2.5 µg/m^3**	**PM 10 µg/m^3**	**SO_2 µg/m^3**	**NO_2 µg/m^3**
Limits	**60**	**100**	**80**	**80**
Mine Area/Ledo	50.6/46.3	79.4/81.3	8.8/12.8	ND/ND
Tea Garden/Ledo	28.2/19.2	59.1/62.7	ND/ND	ND/ND
Ring Gaon/Ledo	12.9/17.6	40.7/49.7	ND	ND
Mine Area/Tikak	50.2/50.7	85.9/84.9	11.7/11.8	5.2/6.3
Near Coal Dump/Tikak	52.6/52.9	80.5/88.6	15.3/14.3	5.9/5.4
Namghar/Tikak	20.6/15.7	43.9/44.8	ND/ND	ND/ND
Panchayat office/Tikak	15.5/16.8	46.6/46.9	ND/ND	ND/ND
Mine Area/Tirap-East	50.8/51.2	85.7/87.4	10.3/16.1	8.8/9.2
Mine Area/Tirap-West	52.7/52.6	82.5/89.1	14.6/17.4	7.3/9.8
Village nearby/Sipegaon/Tirap	16.1/17.4	46.4/47.8	ND/ND	ND/ND
Village nearby/Pachegaon/Tirap	21.8/16.7	46.2/45.9	ND/ND	ND/ND

Note: Two values on either side of slash indicate two different time. Left one April – June average and Right one September–November average

DISCUSSIONS

Three mine areas and nearby habitation areas air quality shows that, though all are within the limit regarding Government notification, but both PM 2.5 and PM 10 are alarming in mine areas and nearby habitation areas. The difference between these areas may be two to three times higher or less as we may consider, but in the long run the impact on human health, especially lung and chest diseases will be negative. Continuous deposition on the tea garden and agricultural fields may change the microbial activities in soil ecological

balance and productivity. This may be taken as first information or diagnosis report for studies on above two aspects.

Conclusion

Around 69% of India's power generation is coal based. Even under a least coal usage scenario, coal will supply more than 40% of the primary commercial energy in 2031-32. Coal is viewed as a key element in increasing energy access in India, as over a quarter of the country does not have access to electricity. Coal will remain the cheapest source of electricity for at least another two decades. During the 13th plan period (2013–2017) the projected additional installed electricity capacity was 118,000 MW, this includes an additional capacity of 69,000 MW of coal-fired power plants.

Coal usage contributed about 970 million tons, or about 49.24% of India CO2 emissions. This GHG emission triggers climatic changes due to rise in atmospheric and surface temperature of the earth. Water and effluent discharge from mines and CHP and OB also has great impact on environment. The challenge is India has to achieve energy security which is needed not only for higher GDP growth but also for assuring inclusive growth to all her citizens and ensuring environmental security.

India's intended nationally determined contribution (INDC), placed in World Climate Change Conference 2015 (COP21), stated programmes in working towards climate justice. Some of these are India GHG Programme, Continuous Emission Monitoring System (CEMS), Common Effluent Treatment Plants (CETPs), Fly Ash Utilization Policy and others with adaptation and mitigation strategies.

Therefore, in this part of the country which is ecologically sensitive area, more powerful studies and measures should be taken to keep the pollutants under control.

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