ASSESSMENT OF AMBIENT AIR QUALITY AT GARE - PELMA COAL BLOCKS AT TAMNAR, DISTRICT-RAIGARH (C.G), INDIA

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ABSTRACT: **- Coal mining is one of the core industries in India. The deterioration of urban air quality due to industrialization or other anthropogenic reasons is of great concern because it poses serious threats to environment and human health. The present study is going to centralized at Gare-Pelma Coal Blocks which is a part of Mand - Raigarh Coalfields at District Raigarh Chhattisgarh. The back ground emission result of AAQM carries the portion emitted by coalmines of the area and allied activities. Baseline environmental data was collected for environmental component i.e. air. The Standard guidelines prescribed by Ministry of Environment & Forests and Central Pollution Control Board have been used during sampling and analysis. This report incorporates the baseline data generated through primary surveys for three months during 02nd October 2013 to 31st December 2013 representing post monsoon season. The air quality (PM_{10}, $PM_{2.5}$, SO_2, NO_X) in the study, the were observed. The values of above said parameters at all stations are within the standard with the air quality standards for respective area categories**

KEYWORDS: Ambient air quality, Coalfield.

INTRODUCTION

The emission of air pollutants due to economic activities involving use and conversion of energy is the major cause of environmental degradation in urban areas. Urban air pollution is a source of multiple problems:

- Smog in urban areas
- historical buildings and monuments deterioration
- vegetation loss
- materials damage due to accelerated corrosion
- health damage due to inhalation of gases and particles

According to World Health Organization (WHO) environmental hazards are responsible for approximately 25 percent of the total burden of disease worldwide (WHO, 2010). There are numerous substances and compounds that are considered air pollutants and many of them originated, and released to the air, because of human activities such as combustion of fossil fuel in industries and in means of transportation.

Air pollution is the introduction of chemicals, particulates, biological materials, or other harmful materials into the Earth's atmosphere, possibly causing disease, death to humans, damage to other living organisms such as food crops, or the natural or environment. In turn, ambient air quality has a direct effect on both public health and the welfare of the Earth's ecosystems. Air normally has no color, odor, or taste. It is a mixture of gases, primarily nitrogen, at about 78%, and oxygen, at about 21%, with the remaining 1% composed of carbon dioxide, methane, hydrogen, argon, and helium. Human activities, such as manufacturing and the burning of fossil fuels, cause changes in the chemical composition of ambient air through the release of chemical and industrial pollutants into the atmosphere.

Its environmental impact cannot be ignored but, to some extent is unavoidable (Chaulya, 2004). Most major mining activities contribute directly or indirectly air pollution. Their air pollutant reduces air quality and their ultimately affects people flora and fauna in and around mining areas (Nanda and Tiwari, 2001). Major air pollutants due to open cast mining are total suspended particles matter (TSP) and settled dust matter. The concentration of particulate matters varies with the meteorological parameters and a relation also exists between TSP settable dust matters. The dispersion of particulate matter follows the annual predominant wind direction of the area Detailed studies of air quality are required to assess the environmental impact of a coal mining area. Analysis of temporal and spatial variation of air pollutant concentration is also essential (Chaulya, 2004) discussed the air pollution problem in Indian open cast coal mine. The purpose of the study is to assess complete information on the status of present air quality status in and around the Gare -Pelma Coal Blocks at Tamnar, District Raigarh Chhattisgarh.

Location Details: Figure 1.1 & 1.2 gives the location of Gare Pelma Coal Block are a part of Mand Raigarh Coalfields. The area is located in Survey of India Toposheet No. 64 N/8 & 64 N/12 on 1:50000 scale.

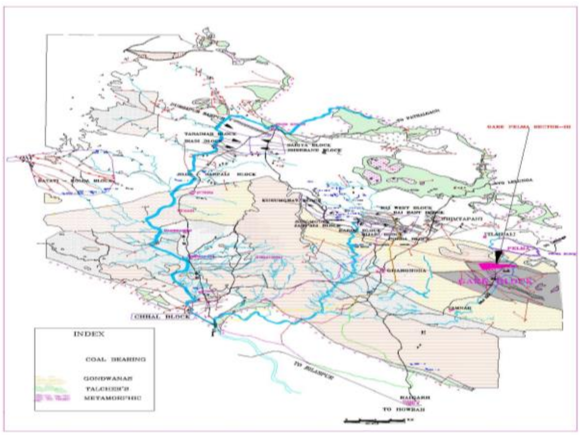

Fig. No. 1.1 location map

MATERIAL AND METHODS

Baseline data has been generated for post monsoon season for ambient air quality of environment. PM_{10}, $PM_{2..5}$, SO_2 and NO_2. Sampling of PM10 and PM2.5 particulate matters have performed with USEPA approved APM 550 attached with gaseous sampler APM 433 monitoring instrument manufactured by M/s Envirotech Instruments Pvt. Ltd. – New Delhi. PM10 and PM2.5 particulate matters were sampled alternatively by replacing the corresponding filter papers to the instrument. PM10 particulate matter was collected on filter paper by filtration of aerodynamic sizes with a size cut by impaction whereas, PM2.5 particulate matter was collected on filter paper by filtration of aerodynamic sizes with a size cut by impaction followed by cyclone separation in APM 550 monitoring instrument. SO_2 and NO_2: gases were chemically absorbed in suitable media. A tapping is provided on the suction side of the blower to provide suction for sampling air through a set of impugners. For SO_2 and NO_2 sampling was drawn at a flow rate of 1.0 & 0.5 Liter Per Minute (LPM) respectively. PM10 and PM2.5 have been estimated by Gravimetric Method (IS 5182 part IV). Colorimetric Improved West and Gaeke Method (IS-5182 Part II, 1969) has been adopted for estimation of SO_2. Colorimetric Jacob-Hochheiser Modified Method (IS-5182 Part VI, 1975) has been used for the estimation of NO_2. Samples were analyzed as per the procedure laid down by the Central Pollution Control Board (CPCB). Ambient air quality (AAQ) samples were collected on basis of 24-hour sampling and twice a week at each site. The ambient air quality samples were collected for continuous 13-weeks beginning from 02^{nd} Oct 2013 to 31^{st} December 2013. The samples were preserved and analyzed as per the standard methods recommended by SOPs of Central Pollution Control Board (CPCB). Dust Sampler with attachment of Gaseous Sampler instruments has been used for Ambient Air Quality monitoring.

AMBIENT AIR QUALITY

The monitoring was carried out for 13 continuous weeks beginning from 2^{nd} October 2013 to 31^{st} December 2013.

S Selection Monitoring Stations:

The topographical information of project site as well as details of the study area about different activities relating to the coal mining and associated activities were collected. The locations of the air quality monitoring stations are described in Table 1.1 below:

Table No.-1.1

Location of Ambient Air Quality Monitoring Stations

Code No.	Locations
A-1	Milupara
A-2	Khamria
A-3	Saraitola
A-4	Kondkel
A-5	Gare
A-6	Libra
A-7	Dolnara
A-8	Salihabhata

RESULT

The observations made for eight sampling stations are presented through Table No. 1.2. In the table, the 24-hour average values of air pollutants have been presented with statistical analysis comprising minimum and maximum, mean and 98^{th} percentile values. Salient features of the values observed for different parameters are discussed in the following paragraphs.

Particulate Matter (PM_{10})

The air quality **(PM_{10})** in the study, the avg. values were observed in the range of 62.15 to 75.97µg/m^3 and the 98^{th} percentile values in the range of 70.35 to 86. 35µg/m^3. It is, therefore, concluded that the PM_{10} levels at all stations are within the standard with the air quality standards for respective area categories.

Particulate Matter ($PM_{2.5}$)

The air quality **($PM_{2.5}$)** in the study, the avg. values were observed in the range of 18.64 to 25.07µg/m^3 and the 98^{th} percentile values in the range of 21.21to 27.47µg/m^3. It is, therefore, concluded that the $PM_{2.5}$ levels at all stations are in compliance with the air quality standards for respective area categories.

Sulphur Dioxide (SO_2)

It can be observed that the SO_2 concentrations at all the sampling stations are well below the ambient air quality standards for residential and rural areas. It will not be out of place to mention that the observed values are also within the standards for sensitive areas.

TABLE 1.2 SUMMARY OF AMBIENT AIR QUALITY STATUS

Location	PM_{10} (μg/m^3)				$PM_{2.5}$ (μg/m^3)				SO_2 (μg/m^3)				NO_2 (μg/m^3)			
	Avg.	Max.	Min	98th Perc	Avg.	Max.	Min	98th Per.	Avg.	Max.	Min	98th Per.	Avg.	Max.	Min	98th Per.
Milupara	64.61	70.50	56.60	70.35	20.03	21.9	17.5	21.81	10.57	11.30	9.20	11.25	13.65	14.60	11.90	14.55
Khamria	66.90	74.50	56.60	74.45	21.41	23.8	18.1	23.82	9.75	10.60	9.20	10.50	12.47	13.90	10.20	13.85
Saraitola	62.15	71.20	54.20	70.70	18.64	21.4	16.3	21.21	8.21	9.3	7.1	9.25	10.08	10.8	9.1	10.80
Kondkel	72.51	82.50	64.50	82.00	21.75	24.8	19.4	24.60	8.38	9.7	7.3	9.65	10.33	11.6	9.2	11.55
Gare	73.91	86.50	63.60	83.85	23.65	27.7	20.4	26.83	8.72	9.8	8.1	9.75	10.05	11.2	9.2	11.00
Libra	75.66	88.20	65.50	86.35	22.70	26.5	19.7	25.91	9.55	9.90	9.10	9.90	13.07	13.90	12.30	13.85
Dolnara	69.77	79.80	64.50	78.15	20.93	23.9	19.4	23.45	8.98	9.90	8.30	9.85	10.92	11.90	10.20	11.85
Salihabhata	75.97	84.20	67.80	83.25	25.07	27.8	22.4	27.47	10.61	11.60	9.60	11.60	12.61	13.80	11.60	13.75

Oxides of Nitrogen (NO_2)

It can be observed that the NO_2 concentrations at all the sampling stations are well below the ambient air quality standards for residential and rural areas.

DISCUSSION

Gaseous pollutant showed maximum concentration along major road sides followed by minor road side; over burden that in the residential area. High level of SO_2 and NO_2 at road site may be attributed to continuous movement of heavy duty vehicle for transporting coal from the mining place to distribution or dumping. Concentration of primary pollutants in the ambient air is generally proportionally to the frequency of emission sources (Pandey, 1992). Furthermore the building ratio plays important role in or dispersion of air pollutants. The SO_2 in the residential area derived from open burning of raw coal and other domestic and commercial activity. SO_2 and NO_2 showed maximum concentration during winter followed by during rainy season. (Table-1.2) A similar pattern of seasonal variation in gaseous concentration around OCP mine was reported by (Jamal et al 1992) in the Gare -Pelma Coal Blocks area. High concentration of SO_2 andNO_2 during winter may be due to frequent temperature inversion, especially during night and early morning hour which restrict pollutant dispersion and the increase the pollutant at ground level. Further the undulating topography of area with medium sized hills also tend to canalize and concentrate pollutant at the site of emission. The present study showed higher annual average compared to the value recorded by around coal mines in Gare -Pelma Coal field.

During the process of open cast coals mining on variety of rock type with different composition are exposed to atmospheric condition and under accelerated weathering. As heavy metals are the important constituents of coal and existing parent rock, mining operation may lead to substantial increase in the amount of toxic substance in the environment (Rimmer 1982).

The sources of heavy metals in the mining area are (i) Soil dust in which the element such as Mn, Ni, Zn etc. and present in the solid form and (ii) Emission by combustion process add in the environment. Some trace metal such as Ni, Pb and Cd, are present in the gaseous form also (Kumar and Ratan 2003). The concentrations of heavy metals in the air environment were closely associated with the variation in the emission Source. The air sample along the road sides showed maximum concentration of heavy metal. Air sample collected from over burden i.e study sites the area situated in close proximity of mining area showed comparatively low level of heavy metals because of their situation from the mining area and also due to the presence of plant patches of green belt that acts as a sink for particulate and heavy metals at these sites. In the air sample Zn showed maximum concentration followed by Mn, Pb, Cr, Ni, and the entire minimum. Zn and Mn are the constituent of parent rock and are commonly parent in soil dust Cr, Ni, and Cd concentration were low in comparison to Zn and Mn and Pb in the TSP. this is because these metals have no specific source in the mining area other than emission from combustion of coal oil etc. In settled dust, concentration of metal were in the following order Zn>Mn>Pb>Cd>Ni>Cr>. Unlike TSP in settled dust concentration Cd was more than those of Ni and Cr. This is probably due to difference in the particle size of their metals.

The study shows that in the mining area concentration of gaseous pollutants are below prescribed standard set by central pollution control board India. But concentration of particulate pollutant exceeded the prescribed limit especially during summer and winter season. Pollutant varied spatially and temporally. TSP and settled dust were the major sources of emission from various opencast mining activities whereas SO_2 and NO_2 were less. The annual average concentration on TSP and settled dust particle were higher that the NAAQS at both monitoring station in the mining area and only a few places in the residential area.

CONCLUSION

Therefore it is recommended to implement a plan of regular cleaning of transportation roads, watering of paved and unpaved roads with chemical binding agents, installation of sprinkles system at high polluting coal transport roads within the plant premises and effective dust suppression mechanism at coal handling plant. It is recommended the green belt with higher dust attenuating plant species may be developed in active as well as abandoned over burden dumps. It is recommends that green belt with higher dust attenuating plant species may also be developed on both side of the road.

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