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# Study the Effects of PM Concentrations on Air Quality in Iron Ore Mines area and its Protective Measures

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**ABSTRACT:** One of our era's greatest scourges is air pollution, on account not only of its impact on climate change but also its impact on public and individual health due to increasing morbidity and mortality. There are many pollutants that are major factors in disease in humans. Among them, Particulate Matter (PM), particles of variable but very small diameter, penetrate the respiratory system via inhalation, causing respiratory and cardiovascular diseases, reproductive and central nervous system dysfunctions, and cancer. PM 10 and PM 2.5 are major pollutants generated in industrial areas causing respiratory problems. Both are present in air and harmful to health. If concentration of particle is high, it penetrates deeply in lungs and its effect on health like breathing problem, sensation in the eye etc. In this study, air pollution is found in mines due to high concentration of particulate matters contained in air due to mining activities and transportation. It is also observed that particulate matter generated in Mines during blasting, shifting of material from mining face to crushing or screening plants, loading and unloading of material, dry crushing, screening of material and transportation of material from Mine pit to railway siding to plants (source of particulate matter). It is observed that concentration of particulate matter, PM10 and PM2.5, in air can be controlled within mining and transportation area through effective safeguard measure. Generation of particulate matter can be minimized by mist water sprinkling, by using dust suppression chemical on road, reducing no. of trucks, dry fog system, dust extraction system, developing black top road and transportation through close conveyor up to railway siding.

**KEYWORDS:** Air Pollution, PM10 and PM 2.5 concentration, Minimization.

## I. INTRODUCTION

The interactions between humans and their physical surroundings have been extensively studied, as multiple human activities influence the environment. The environment is a coupling of the biotic (living organisms and microorganisms) and the abiotic (hydrosphere, lithosphere, and atmosphere). Pollutants are harmful solids, liquids, or gases produced in higher than usual concentrations that reduce the quality of our environment. So, particularly mines activities cause major air pollution as it is highly rich with iron ore and manganese ore. Gua and Barajamda area is in west Singhbhum of Jharkhand surrounded with Ghatkuri Reserve forest and covered with laterite, ferruginous shale and limonitic shale. 12 leases are there in which 2 Mines are running. Other all Mines have been closed as per modified MMDR act 2015 and due to other statutory clearance.

Concentration of dust is very high due to Mining and transportation of Iron and Manganese material. Mining activities are going on in high altitude and concentration of dust in this area also depends on metrological condition like wind direction, protective measure taken by lease in different Mining activities like Blasting, Excavation, Shifting of material from quarries to crusher or Screening plant with Dumpers, crushing and screening, storage of material and transportation from mines to railway siding. NO<sub>2</sub> and SO<sub>2</sub> concentration in air due to mining activities is standard of limit but the concentration of PM10 and PM 2.5 more than permissible limit. Thus, the control of dust emission is a matter of utmost importance for any mining region as it contains free silica and respirable particulate matter which causes lung diseases (Sharma and Roy, 1997; Sinha and Banerjee, 1997; Shannigrahi and Sharma, 20).

## II. APPROACH TO THE PROBLEM

Air pollution has various health effects. The health of susceptible and sensitive individuals can be impacted even on



low air pollution days. Karo river and Koina river flow through this area and many Nallah originated from this region. Nearest district Town is Chaibasa, West Singhbhum. Local people, of Baraiburu Bichaigiri, Tatiba Gua, Nuia, Baihatu, Bokna Chautambasai, Titlight depend on Mining and Mining allied activities. Main Mining ores are Iron and Manganese. Jharkhand state highway 4 passes through this area.

#### A. Area under case study

Area is affected mainly dust, generated due to Mining of Iron and Manganese ore and transporting through Trucks. All local people depend on Mining and Mining related work. Air is polluted due to concentration of dust in air.

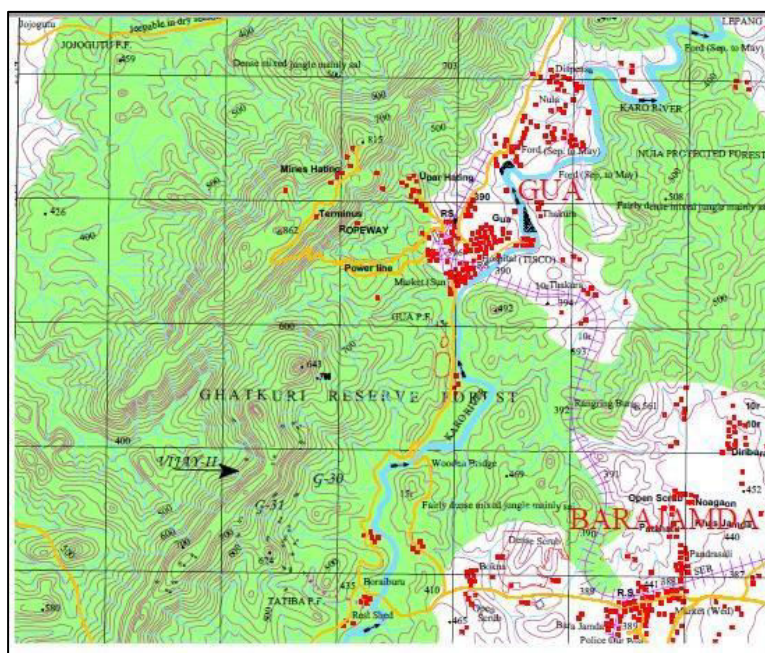


Fig.1 Geographical location of study Area

#### B. Source of Pollution

It is known that the majority of environmental pollutants are emitted through large-scale human activities such as the use of industrial machinery, power-producing stations, combustion engines, and cars. Because these activities are performed at such a large scale, they are by far the major contributors to air pollution, with cars estimated to be responsible for approximately 80% of today's pollution. Some other human activities are also influencing our environment to a lesser extent, such as field cultivation techniques, gas stations, fuel tanks heaters, and cleaning procedures, as well as several natural sources, such as volcanic and soil eruptions and forest fires.

Now a day, only two mines are running but 5 Mines have been closed as per MMDR act 2015. The main source of dust generation in this area are mining, mining related work i.e. blasting, excavation, shifting of material to Crusher, during crushing of material, in screening plant, than shifting material from plants to stock yard and transportation of material. Blasting is done in this area with explosive (slurry explosive) with nickel or ammonium nitrate. During blasting lot of dust generated in that area and it blows with wind. After blasting material handle with excavator and shifted to crushing and screening plant with dumper and movement of dumper lot of dust generation along the haul road. In crusher 60mm boulders are crushed to required size 5x18mm, 10x30mm, 10x40mm and fines and during this dry process lot of dust generated in plants. As per general practice in mines this products material shifted to different stockyard with dumper or Trucks. Separate stack yard are for size ore and fines. Dust is also generated from this stack with the blow of wind. So wind also play important role in generation of dust in mines to pollute air of local area. The material is loaded in dumper or in Trucks with loader and dust is generated in loading and in unloading point. Maximum dust is generated during transportation along the transportation road from mines to railway siding or stock yard out of lease area. Trees contain lot of dust and when wind blow these dust spread in air increase the concentration of dust as shown in Fig.2 As per

earlier study (Ferreira et al., 2000; Chauhya,2006; ELAW, 2010; Singh et al., 2010; Trivedi et al., 2010; Tripathiet al., 2014) on source of Air particle generation are Mining and transportation and also Wind direction and speed play important role.

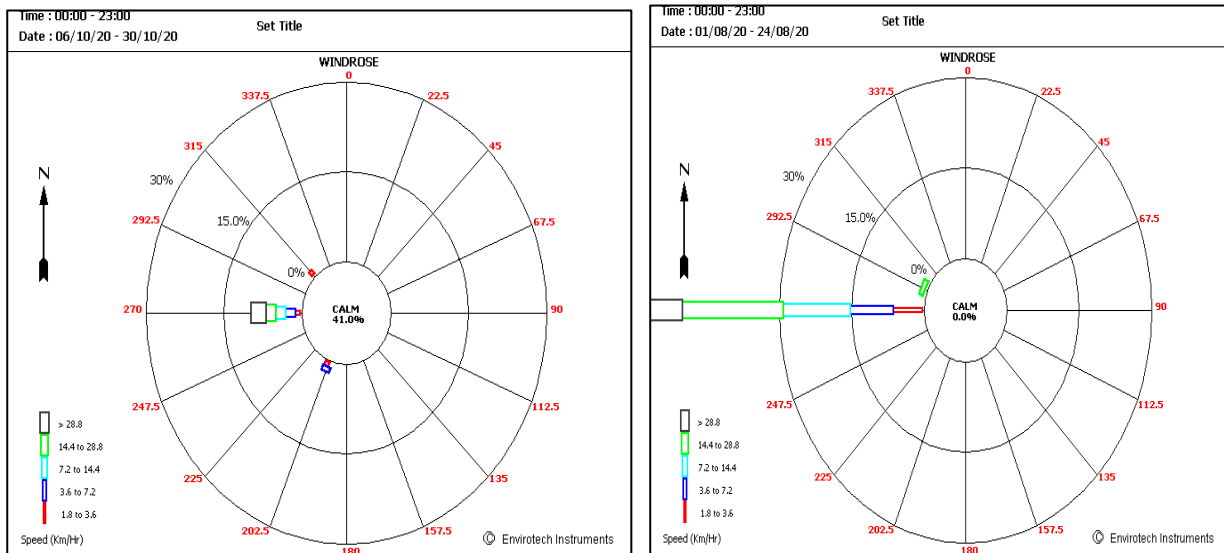


Fig. 2 Flow diagram of Wind in this area

**B. MonitoringStation in Ghatkuri Reservation**

Iron ore mining plays an important role in the economic development of the region, state and the country along with contribution to the fugitive dust emission adding to the problem of air pollution either directly or indirectly, at all stages from exploration to exploitation, including mineral processing (Dutta et al., 2004; Patra et al., 2008; Jain, 2013; Das, 2014; Chaturvedi and Patra, 2016). The major sources of air pollution in the mining areas consist of drilling, blasting, loading and unloading of minerals and exposed overburden, the transportation and also dust generation by wind at stock yards, mineral handling plants, exposed pit faces and workshops (Ferreira et al., 2000; Chauhya, 2006; ELAW, 2010; Singh et al., 2010; Trivedi et al., 2010; Tripathi et al., 2014).Air pollutants emitted from these mining activities deteriorate the local the environment and ecology, which ultimately affects the flora and fauna that live in and around the mining leases. Air Quality analysis report collected from Continuous Ambient Air Quality Monitoring System- Analyzer installed with this instrument and result found in Table 1 and 2. The seasonal air quality and its improvement is shown in Fig. 3&4.



Table 1 Data collection and analysis

Date	SO2 ug/m3	NOX ug/m3	PM10 ug/m3	PM2.5 ug/m3
04.11.20	14	12.1	126.93	48.09
05.11.20	31.98	15.5	105.92	47.59
06.11.20	17.63	13.9	56.76	25.32
07.11.20	15.99	12.3	118.94	50.32
08.11.20	11.67	11.3	119.63	53.72
09.11.20	13.6	17.7	97.03	28.69
10.11.20	25.25	21.1	96.74	39.86
11.11.20	18.96	19.1	85.17	29.37
12.11.20	15.9	17.7	75.24	21.23
13.11.20	16.91	19.2	107.34	27.86
14.11.20	26.15	19.4	110.61	35.39
15.11.20	23.14	14.7	87.31	35.57
16.11.20	17.51	12.3	92.34	38.42
17.11.20	24.42	10	90.2	44.99
18.11.20	27.18	15.3	96.86	44.95
19.11.20	27.71	19.8	87.56	40.48
20.11.20	13.58	9.84	53.06	24.6
21.11.20	9.52	10.3	55.15	26.21
22.11.20	10.35	14.1	78.19	41.33
23.11.20	19.93	22.2	114.72	41.98
24.11.20	27.59	28.3	120.55	48.96
25.11.20	30.36	23.5	134.99	48.58
26.11.20	35.16	32.1	159.58	57.65
27.11.20	27.69	25.3	119.52	47.12
28.11.20	13.46	18.6	56.9	17.6
29.11.20	14.24	18.2	75.4	29.19
30.11.20	22.09	21.2	73.86	29.34

Table 2 Post monsoon data collection and analysis

Date	SO2 ug/m3	NOX ug/m3	PM10 ug/m3	PM2.5 ug/m3
20.10.20	4.58	14.4	148.57	29.97
21.10.20	11.34	20.4	211.94	59.9
22.10.20	7.72	12.7	82.37	19.5
23.10.20	7.38	6.84	17.38	17.9
24.10.20	7.7	5.3	41.49	17.53
25.10.20	11.44	6.54	84.76	29.6
26.10.20	9.78	6.73	75.97	30.16
27.10.20	12.72	7	94.3	41.63
28.10.20	11.63	12.7	114.09	39.82

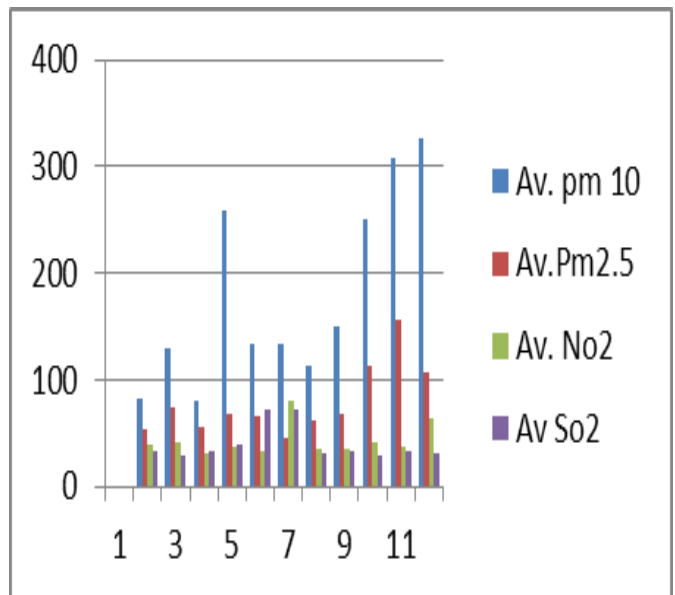


Fig. 3 Air qualities in local area

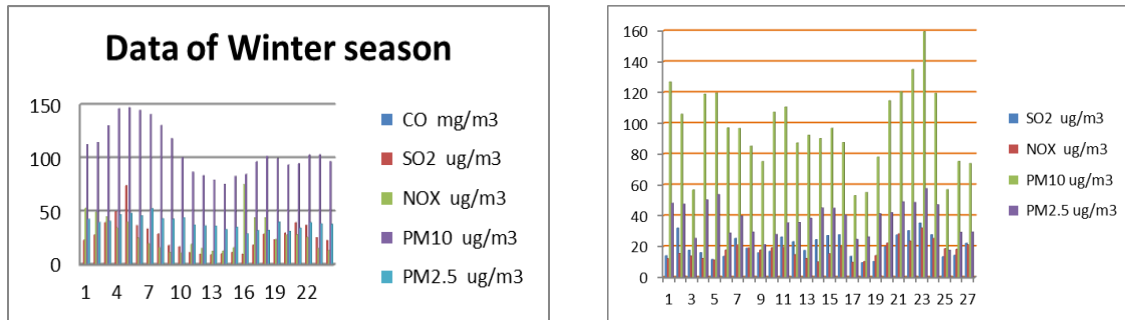


Fig. 4 Data analysis diagram

### III. CONCLUSION

So Air is polluted by particulate, generated by Mining activities and transporting vehicles and due to which different lungs related diseases found in this area and it can be prevent through preventive measure to control dust generation along the road and in mining activities in this area. The following preventive measures may be taken to mitigate the pollution.

Protective measures to minimize air pollution from different source

- To reduce particulate pollutant in air, we are to reduce generation of dust from different sources. During blasting huge dust is generated and to reduce the dust generation, Blasted area to be cleaned and level to be maintain before drilling and water to be sprinkled to reduce dust generation.
- Excavation & loading area, properly maintained road and loading area and regular water sprinkling can reduce dust particle generation.
- Dry processing of material in crushers, all villages in this area mainly affected by dust generated by transporting Truck as all transporting Trucks moves through Kachcha road and carry out of dust by wheel and spread in air.

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