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AIR POLLUTION DUE TO COAL MINING IN LAKHRA COALFIELD

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Abstract

Due to active coal mining in Lakhra, a huge amount of coal is dumped in the open air and is them loaded on trucks for transportation to the various parts of the country. Due to this, fine coal dust particles disperse in air in the form of suspended particulate matter (SPM) polluting the air. The suspended particulate matter (SPM) is major source of Silicosis and pneumoconisis diseases among the people working and living in the area. The present study deals with the amount of SPM dispersed in air, chemical analysis of these particles and their impact on environment.

Key Words: air pollution, coal mining, Lakhra coalfield,

Introduction

Air pollution is an atmospheric co state in which certain substances are present in such concentration that they can produce undesirable effects on man and environment (Rao, 1995). These substances include gases like Sulfur dioxide, nitrogen oxide, carbon monoxide, hydrocarbon, smoke, fumes,, aerosols, radio active material, particulate matter (dust etc.) Most of these are naturally present in the atmosphere in tolerable concentrations, but these are considered harmful (and called air pollutant) when their concentration exceeds threshold limit (i.e 260 μ g/ m^3 or 0.1ppm in 24 hours) or low concentration.

Lakhra coal mines are situated between Latitude 25° 30' and 25o 45' N and longitude 68° 0' E and 68° 15' E (Survey of Pakistan topographic sheet. NO. 40 C/1 and 40 C/2) in district Dadu, about 64 km. North west of hyderabad in Sindh province (Fig.1) The field convers an area of about 680 sq. kilometers. Coal is found at a shallow depth of 50-150m. Annual production from this single coal field is estimated at more than 1.7 million tons per year. In Lakhra underground mining is practiced for exploring the coal that causes emission of fugitive dust, which comprises of tiny particals more toxic than their parent coal lump. Suspended Particles may be assumed as solid contaminant in a state of minute sub-division present in the air, they cause "Black Lung Disease" beside Silicosis, pneumoconiosis and bronchitis. In Lakhra coalfield two types of dust haves been found (a) Respirable and (b) Non Respirable. Those particles which weight 5 mg or below are termed as respirable particles. While the larger particles are are called non - respirable dust particles and cause constant irritation of the upper respiratory track and "Bronchitis" diseases (Table 1 & 2). Beside fine coal particles in the Suspended Particulate Matter other heavy metals have also been analyzed in it, that cause hazardous environmental diseases among the peoples working there.

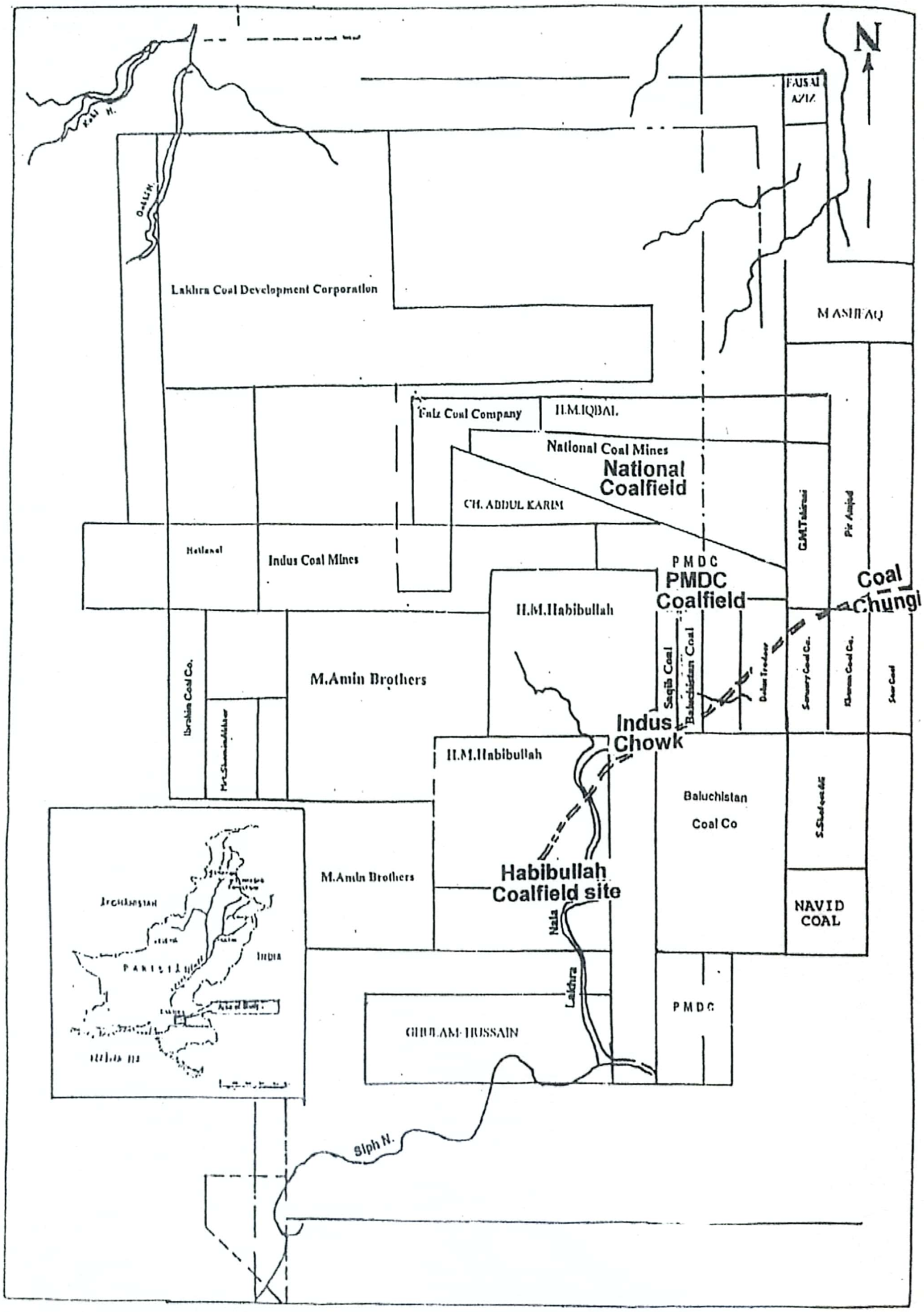


Figure 1. Location Map of Lakhra coalfield showing Sites from which Air samples were collected .

posions at different locations.

Sample No	Location (at ground level)	Weight (in gms)	Location (in hanging position)	Weight (in gms)
1.	National Coal Field	2.93	National Coal Field	1.512
2.	Indus Chowk	0.382	Indus Chowk	0.580
3.	PMDC Coal Field	1.476	PMDC Coal Field	0.928
4.	Coal Chungi	0.195	Coal Chungi	0.14
5.	Habibullah Coal field site	1.281	Habibullah Coal field site	0.113

Table 2. Threshold Limit Values (TLV) and Toxicity of Some Heavy Metals

Element	TLV (AIR)	Toxicity
Cu	0.2-0.83 mg / m^3	Wilson disease, Liver problem
Cd	01- 0.05 mg / m^3 (0.002-0.048µg/m^3	Hypertension, respiratory disorder, damage to Kidney and liver, formation of kidney stones, Osteoporosis, etc.
Pb	0.15 (200mg) (in 8 Hours)	Nephritis (kidney diseases), convulsion, insomnia, headache, Tremor, Fever.
Ni	1.0 (Metal/insoluble) (or 100µg/m^3)	Carcinogentic (skin), Carbonyl Poisoning.
Zn	15mg / m^3	Fever, Tremor
Co	100µg/m^3	Beer drinker's disease, Polycythemia and Goitre
Fe	0.2µg/m^3	

Methodology

Air sampling was carried out in two different ways. Suspended particles were collected in clean plastic pans (30 cm diameter), half filled with distilled water. One group of samples was collected from the ground level position, while the other group was collected by hanging the pan with some support at man's nose height (about five feet above ground level), for each group five different locations were selected (Figure/ Map 1).

The sample collected in distilled water, were filtered through whatman No. 42 filter paper, and the residue were collected and dried in the oven at above 800°C over night. The residue was then weighed in order to calculate the rate of dust fall during the placing time; 24 hours (Table 1). Each dired sample was kept in a glass bottle for the determination of heavy metals. A known weight (0.2 g or blow) of

each collected particulate matter was taken in the Teflon beaker, in which 5 to 10 ml of HNO3 was also added, that evaporated at 100°C, until the paste was obtained. This was followed by the addition of 20 ml of 2N HCl and heated at very low temperature for a few minutes. Afterwards the solution was filtered through a very fine (whatman No. 42) filter paper in a 25 ml volumetric flask. This solution was stored in polyethence bottles for the determination of heavy metals (Copper, Lead, Nickle, Cobalt, Cadmium and Iron), by SP 191 PYE UNICAM Atomic Absorption Spectrometer, at the geochemistry laboratory of National Center of excellence in Geology, University of Peshawar. The results are given table 2 and 3. In air samples collected from Lakhra coal field, the concentration of the heavy metals have been found highest in the air samples collected from the ground level position and comparatively low in the samples collected from the hanging position (Table 3 & 4) Fig. 2.Table 1.

Discussion

At the National coal mining site, it has been studied that the concentration of Cr, Ni, Cu, Co and Zn in the air is high (Figure 2). While the concentration of Cd at this point is quite low. But at PMDC coal mining site the concentration of Zn and Pb in air is higher than the concentration of Cr, Ni, Cu & Fe. The reason may be due to the location of these coal mines, as both the National and PMDC coal mines are located on the brink of only mettled road in the area on which overloaded trucks run round the clock, so the reason may be two fold auto exhaust and the dispersed fine coal particles from the coal mines. At the Indus chowk it has been observed that

concentration of Cu, and Zn is higher than the concentration of Co, Ni and Fe but at the same location the concentration of Cd and Ni is less. But at the coal chungi site near the coal fired power station, where all the coal loaded trucks are supposed to stay for a while and pay toll tax the concentration of Cu and Zn is higher than the concentration of Cr, Ni, Pb, Fe and Co while at the same location it has been found that the concentration of Cd in air is quite low (0.0111 pm). At Habibullah coal field site it has been observed that the concentration of Cu is extremely high but at this location Pb is almost negligible.

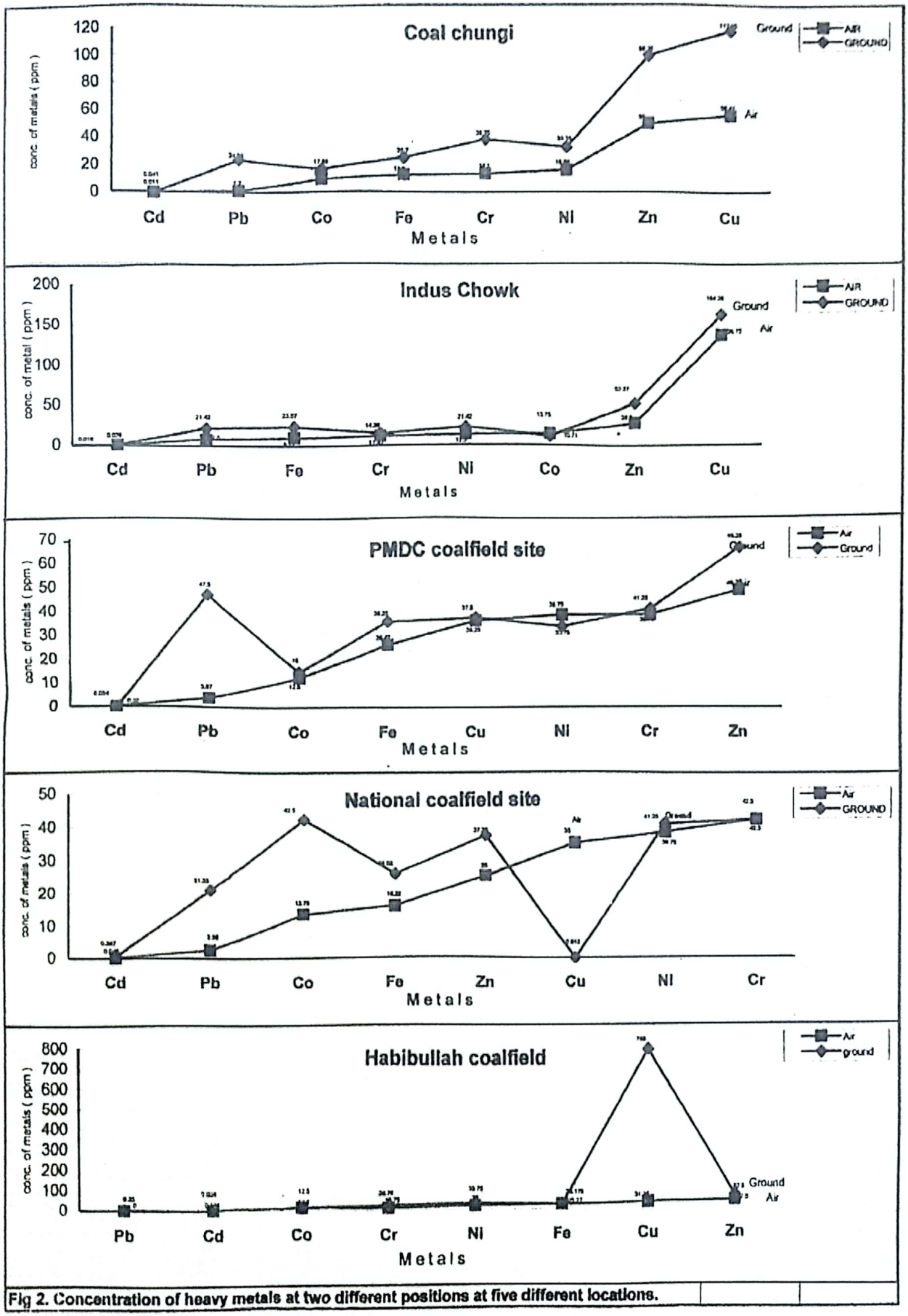


Fig 2. Concentration of heavy metals at two different positions at five different locations.

Table 3. Concentration of heavy metals in air (samples collected from various locations) at hanging position.

Location	Cd	Cr	Co	Ni	Cu	Zn	Fe	Pb
National Coal field	0.048	42.50	13.75	30.00	35.00	25.00	16.22	2.56
Indus Chowk	0.028	11.25	12.50	12.50	138.75	28.2	9.72	7.50
PMDC Coal Field	0.02	38.75	13.75	38.75	36.25	48.75	26.47	3.87
Coal Chungi	0.011	14.10	10.25	16.66	56.41	50.00	13.20	1.75
Habibullah Coal field site	0.023	13.75	12.50	20.00	31.25	37.5	25.27	BD

Table 4. . Concentration of heavy metals (ppm) in air (samples collected from various locations) at ground level position.

Location	Cd	Cr	Co	Ni	Cu	Zn	Fe	Pb
National Coal field	0.387	42.50	42.50	41.25	0.012	37.25	26.02	21.25
Indus Chowk	0.016	14.28	10.71	21.42	164.28	53.57	23.57	21.42
PMDC Coal Field	0.034	41.25	15.00	33.75	37.50	66.25	26.47	47.50
Coal Chungi	0,041	38.7	17.69	33.18	117.25	99.55	25.70	24.33
Habibullah Coal field	0.024	28.76	12.50	33.75	785.00	62.50	26.175	6.25

Conclusion and Recommendation

As the analysis of SPM shows that in all places it is extreamly high at ground level as well as in hanging position except at PMDC coalfield Site, While at Coal chungi Site near Coal fired Power Station, where coal loaded truck stay for a while to pay the Coal toll Tax and the coal fired Power Station is nearer, it has been observed that concentration of Cu as well Zn, Cr, Co and Pb is higher than the Cd that is quite low (0.041 & 0.011 ppm). It has also observed that at this place concentration of these metals is higher in

air than the concentration of heavy metals at ground level. While at the Indus Chowk, it has been also found that concentration of heavy metals at ground level is higher than

the concentration of these metals at nose level or in hanging position.

It has been also observed that this place Cu is extremely higher in air as well as at ground level position but at this place too concentration of Cd is quite low at both positions, i.e. at ground level as well as in hanging position. While at PMDC colfield site, it has been observed that situation is different from other locations, at this place it has been noticed that the Lead (Pb) at ground level position as well as in hanging position is higher than the other locations. The concentration of Zinc at this place is also extremely high, especially at ground level position. While other metals except cadmium, (i.e. Fe, Cr, Ni, and Cu) at this place is also high, the reason may be two fold, its location, as this site is on the brink of the only mettled road that is linked to the Lakhra Coalfield and the active mining is being taking place around this coalfield site. It has been also observed that at National Coalfield site concentration of Cr and Cobalt is higher than the Ni, Cu, Zn and Fe at this place, it is has been observed that at this place concentration of Cu at this place at the ground level position is higher than its concentration in hanging position, like that the concentration of Pb at ground level position at this place is also higher than its concentration in hanging position, but at location also the concentration of cadmium at hanging as well as at ground level position is quite low. Surprisingly at this place the concentration of Pb, Cd, Co, Cr, Ni, Fe and Zn at ground level as well as in hanging position at Habibullah coalfield Site is lower than at other places, but at this place it has been observed that concentration of Cu at ground level position is higher than its concentration in hanging position (Fig 2). Following recommendation are suggested for the Pollution free mining environment at Lakhra coal field:

As dust can cause irritation, particularly to the eyes mucous membrane, so strict measuress should be adopted to combat it, miners should be provided air masks and dust suppression and extraction system should be provided at each mining site.

About 7000 tons of coal per day is transported to the various parts of the country from Lakhra. It is assumed that about 0.05 – 1% of coal is lost due to handling and transportation, that also pollute the air. It is therefore recommended that water or suitable chemicals should be sprayed on top of trucks carrying coal. In this respect NLC type sealed containers may also be used for coal transportation.

To reduce dispersion of Suspended Particulate Matter in air hoods should be constructed at the transfer or storage points.

Dense belt of trees should be planted on rod sides. Three trees would serve as dust arresters, since it has been estimated that trees planted on one hecter can catch (arrest) about 40 tons of dust.

For controlling dust or Suspended Particulate Matter growing grass or herbs should be planted.on dumping site.

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