" IMPACT OF COAL MINING ON WATER AND NOISE : A CASE STUDY OF JAMUNA KOTMA COAL MINES AREA"

Satyam Mishra[1] M. K. Koshta[2]
[1]M.E. Student [2]Associate Professor
1,2 Department of Civil Engineering
1,2 Jabalpur Engineering College, Jabalpur, Madhya Pradesh, India

ABSTRACT

Coal is a major source of energy in India and the world for many past decades but it has also proved as one of the largest source of carbon dioxide, sulphur dioxide with metal concentration especially Fe, Cu, Mn and Ni releases. Coal mining is basically associated with the extraction of coal mineral and resulting in degradation of natural resources like air, water, land and the destruction of habitat with extensive noise pollution of heavy machineries, blasting and excavations .Thus, poses a threat to surrounded biodiversity. Also, Water systems are greatly affected by coal mining. For example, mining affects groundwater and water table levels with acidity, high hardness, decreased pH, TSS, heavy metals and bacterial contaminants. It degrades the water quality .The noise pollution caused hearing loss and affected the mental and physical health in many ways. The noise in mining generally occurred by Operation of heavy duty earth moving machines, Blasting, Crushing, Screening and various Loading operations which exceeded the permissible noise limits. Thus this study is aimed to assess the impact of coal mining on the water and attempts to make a realistic examination of water and noise pollution due to mining activities and processing carried out in the Jamuna Kotma Coal Field Region in the district of Anuppur, Madhya Pradesh(India).

Keywords: Acid mine drainage, coal mining, environmental impact, leachate characteristics, water quality, Jamuna Kotma, noise pollution.

Abbreviations: U/G –Underground, OCM- Opencast mine, SPM – Suspended particulate matter, BOD- Biochemical oxygen demand , COD- chemical oxygen demand.

1. INTRODUCTION:

Coal is commonly called the black gold which is a combustible black or brownish-black sedimentary rock. Coal is the most abundant available fossil fuel around the globe which meets a major part of the conventional energy source needed for human consumption. it contributes a major part to production of energy for commercial and domestic need and hence it is widely used in the industries to generate electricity. it usually occurs in rock strata in layers or veins which are called as coal beds or coal seams. Coal mining is particularly surface mining which requires large areas of land to be disturbed and excavated using various mechanical means. This raises a number of environmental challenges, including soil erosion, air, noise, water pollution and impacts on local biodiversity. However, as compared to other fossil fuels, coal generates more pollution holding less energy production efficiency. The activities which are responsible for pollution around coalmining areas are drilling of mineral, blasting using explosives, loading and unloading of coal and overburden, dust from hauling roads and transport roads, exposed overburden dumps in open areas, coal handling plants, exposed faces of pits, presence of fire in coal mineral, exhausts and dust from movement of heavy machineries, crushing of coal , mine water discharge, open pits and collapse of abandoned mines. Environmental effects of coal mining are potentially very broad which creates air, soil, noise, water pollution and loss of biota. Hence, the environmental impacts of coal mining sites must be assessed periodically with in fixed time interval for air, water and noise quality assessment.

2.Materials and Methods

2.1 Geography of Study area

Jamuna Kotma area is located in Anuppur District of Madhya Pradesh. Anuppur situated between latitude 23 0' and 23 15' and longitude 81 45' and 82 05'0.The surface has maximum elevation of 573.47 and minimum elevation 512.42 m respectively from Mean Sea Level. National Highway 78 is also passing along northern side of the area. Regional mine headquarter is situated about 6.5 km south of Kotma railway station. Kewai River is passing along the north-south side of monitoring area. The area is gently undulating with the general slope towards River Kewai (Area falls under SOI toposheet No. 64E/16 and 64I/4). The temperature varies here from 4.9 to44 ^{0}c with average annual rainfall of 1430 mm.

Fig1: location of various coalmines

For water and noise level monitoring, SIX number of monitoring colliery sites were selected. These collieries are Bhadra UG mine, Jamuna UG mine, Govinda UG mine, Amadand OCM, Amadand UG mine, Bartarai UG mine were selected in different directions and distances in coal mining area of Jamuna Kotma coal mining area. Various different points of sample collection from both commercial and residential areas have been selected so as to compare the various aspects of pollution and its effect.

Table:1 The characterization of monitoring sites is detailed in Table Below:

Table 1.1- Monitoring sites for Water Quality Analysis:

S.No.	Colliery	Code	Site Name
1.	Jamuna U/G Mine	A	Mine discharge 9/10 incline
		B	Mine discharge ½ incline (filter plant)
		C	Mine discharge ½ incline (kushiyara village)
2.	Govinda U/G Mine	D	Mine discharge govinda incline
		E	Mine discharge meera incline
		F	Mine discharge meera incline (municipal pond)
3.	Amadand U/G Mine	G	Mine discharge amadand incline
4.	Amadand O/C Mine	H	Mine discharge amadand OCM
5.	Bartarai U/G Mine	I	Mine discharge Bartarai Incline
6.	Bhadra U/G Mine	J	Mine discharge narayan incline

Table 1.2- Monitoring sites for Noise Level Analysis:

S.No.	Colliery	Code	Class	Site Name
1.	Jamuna U/G Mine	1.	B	Jamuna filter plant
		2.	A	½ incline
		3.	B	Jamuna colony
2.	Govinda U/G Mine	4.	A	Govinda incline
		5.	A	Meera incline
		6.	B	Govinda staff colony
3.	Amadand U/G Mine	7.	A	Amadand incline
4.	Amadand O/C Mine	8.	A	Sub station
		9.	A	Excavation office
		10.	B	Nimha village
5.	Bartarai U/G Mine	11.	A	Bartarai Incline
6.	Bhadra U/G Mine	12.	A	Narayan incline
		13.	B	Bhadra colony

Class: A- Industrial, B-Residential

2.2. Methods of Monitoring:

Sampling and field work:

Samples were collected as per the guidelines of APHA. Each sample was taken in clean plastic bottle and kept in iceberg on the field. Turbidity, Temperature, Total Suspended Solid, Oil & Grease, pH, COD, BOD were tested in a laboratory while BOD bottles were filled at site and reagents for DO fixation were mixed at the time of sample collection. NOISE monitoring was conducted with the help of noise level meter at various points of noise pollution like The movement of coaling machines and transport units-conveyor, tubs and transfer points and at time of mine blast at various distance of 30m and 70 m Various methods used for monitoring is described below:

S.No.	Parameter	Method of Testing
1.	Temperature	IS 3025-8(1984);thermometer
2.	Turbidity	IS 10500(2012);Nephelometer
3.	Total Suspended Solids	IS 3025-17(1996) GRAVIOMETRIC method
4.	Oil and Grease	5520 B. Partition-Gravimetric Method
5.	pH	IS 3025-12(1983); Electrometric method
6.	COD	APHA;5220 B. Open reflux titration method
7.	BOD	IS 3025-44(2003); 3 day incubation at 27^0C
8.	Noise level	CPCB protocol for ambient level noise monitoring

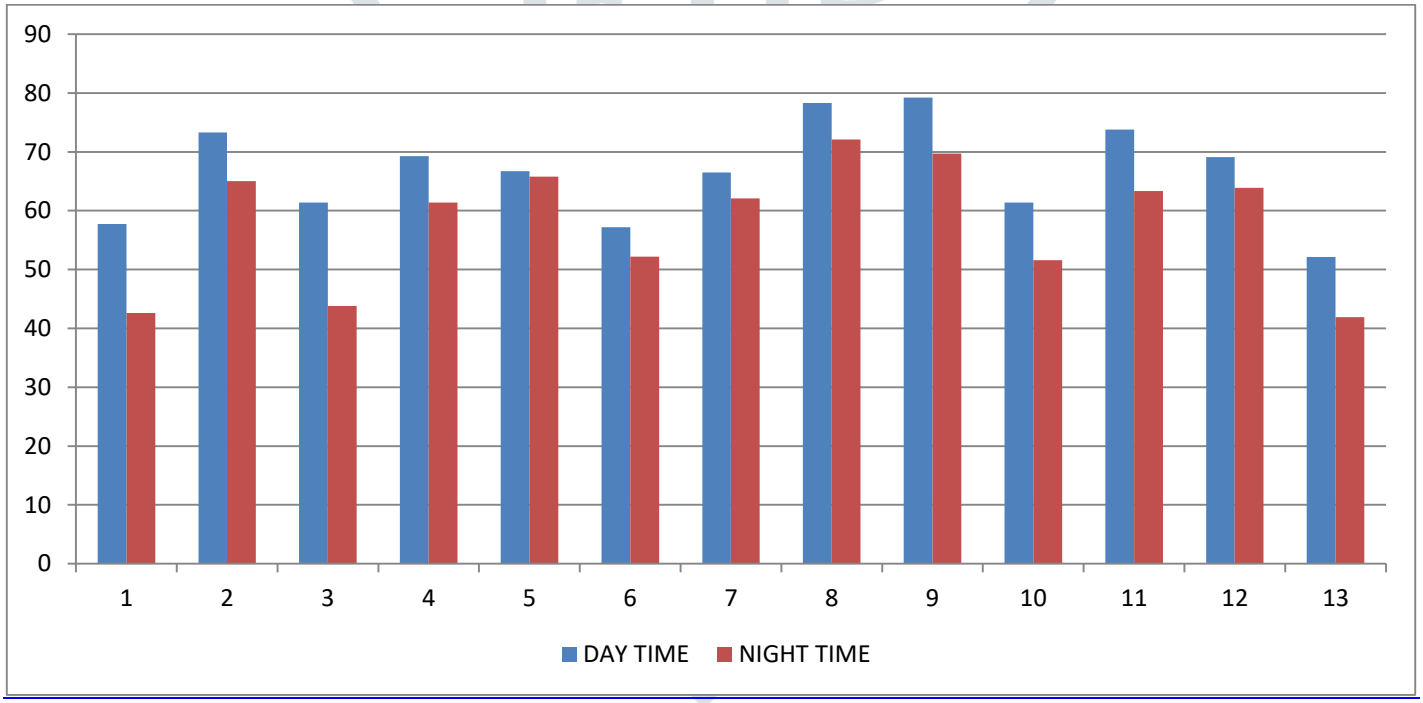
3.Results and Discussions :

3.1 Noise Pollution

The most noise generating equipment underground are the haulage, ventilators-main, auxiliary and forcing fans, conveyor transfer points, cutting and drilling machines. The ambient noise level due to different operations in underground mines varies within 50-80 dBA. whereas In a opencast mine of Amadand Collieries, the noise level near blasting pits, fan house, conveyor system, shearer and road headers was reported to be within 75-80 dBA which is quite higher than permissible limits of 75 dBA in day time as well as in nights also. The higher noise level was recorded in nearby residential areas from 40-75 dBA where permissible limits are upto 55 dBA.

Various results of noise levels are as under:

PARAMETER `	NOISE POLLUTION				
Sampling Time				Day	Night
LIMIT in dB(A)	INDUSTRIAL -A			75	70
	RESIDENTIAL -B			55	45
Colliery	Class	S.no.	Site Name	Day	Night
Jamuna U/G Mine	B	1.	Jamuna filter plant	57.75	42.6
	A	2.	½ incline	73.32	65.01
	B	3.	Jamuna colony	61.4	43.8
Govinda U/G Mine	A	4.	Govinda incline	69.3	61.4
	A	5.	Meera incline	66.7	65.78
	B	6.	Govinda staff colony	57.21	52.2
Amadand U/G Mine	A	7.	Amadand incline	66.5	62.1
Amadand O/C Mine	A	8.	Sub station	78.28	72.12
	A	9.	Excavation office	79.24	69.7
	B	10.	Nimha village	61.4	51.6
Bartarai U/G Mine	A	11.	Bartarai Incline	73.78	63.36
Bhadra U/G Mine	A	12.	Narayan incline	69.1	63.88
	B	13.	Bhadra colony	52.14	41.9

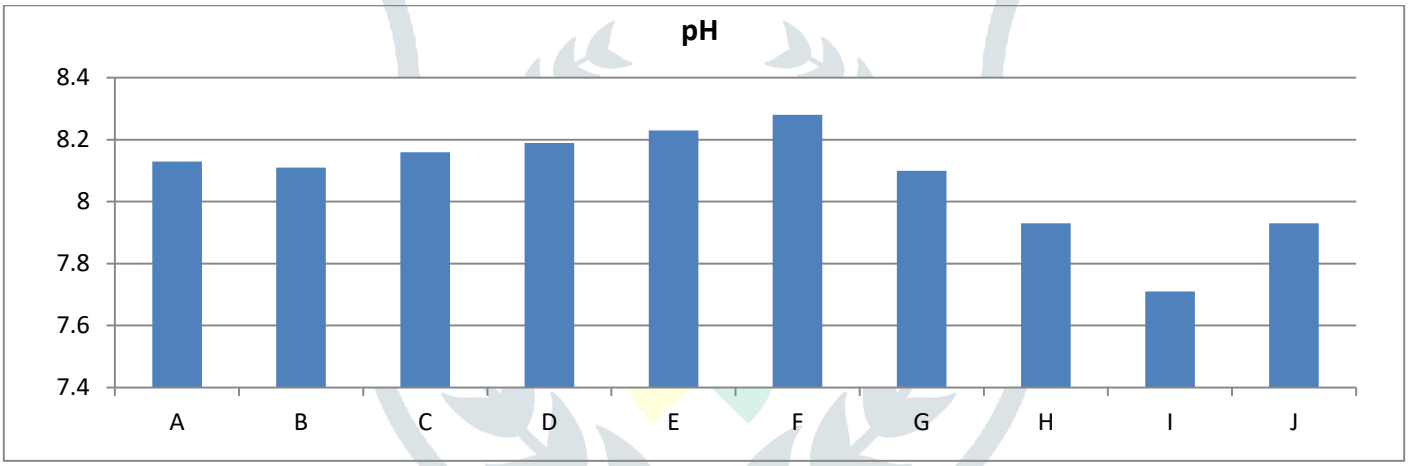


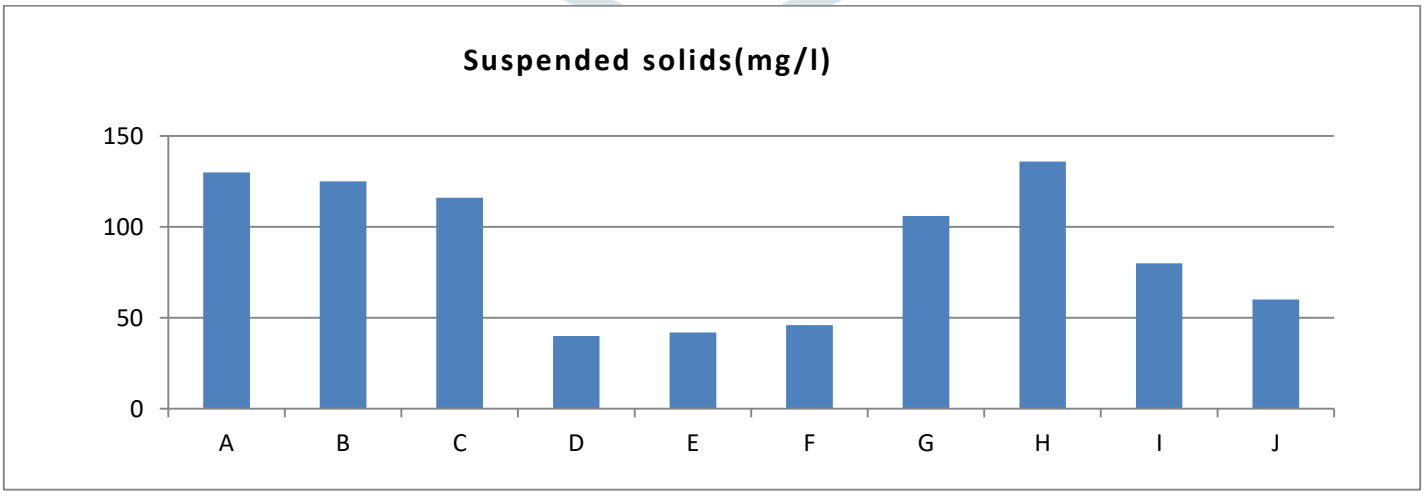
3.2 Water Pollution

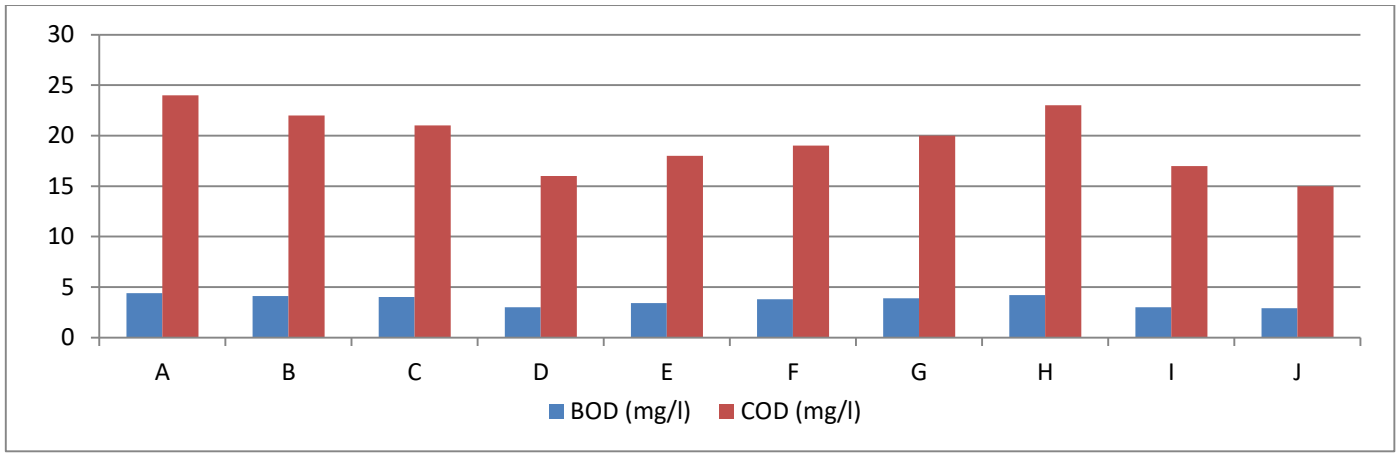
The mine water from various outlets was collected and was tested. The water colour was found dark blackish at Bhadra mine to clear water at Bartarai mine. the mine water can be acidic or neutral in nature. It depends upon the pyrite content in the coal as inorganic impurities. The pH of all mines was found to be approximately neutral and which indicates lower influence of pyrite. The suspended solid concentration was analysed by graviometric technique and its concentration was found higher than permissible limit of 100 mg/l at discharge of Jamuna U/G Mine, Amadand U/G Mine and Amadand O/C Mine which resulted in increased turbidity and crossed the permissible limit of 10 NTU as CPCB guidelines. Remaining all i.e. BOD, COD, Temperature ,Oil and grease were found under safe limits.Water-pollution problems caused by mining include acid mine drainage, metal contamination, and increased sediment levels in streams. Sources can include active or abandoned surface and underground mines, processing plants, waste-disposal areas, haulage roads, or tailings ponds. Sediments, typically from increased soil erosion, cause siltation or the smothering of streambeds. This siltation affects fisheries, swimming, domestic water supply, irrigation, and other uses of streams.

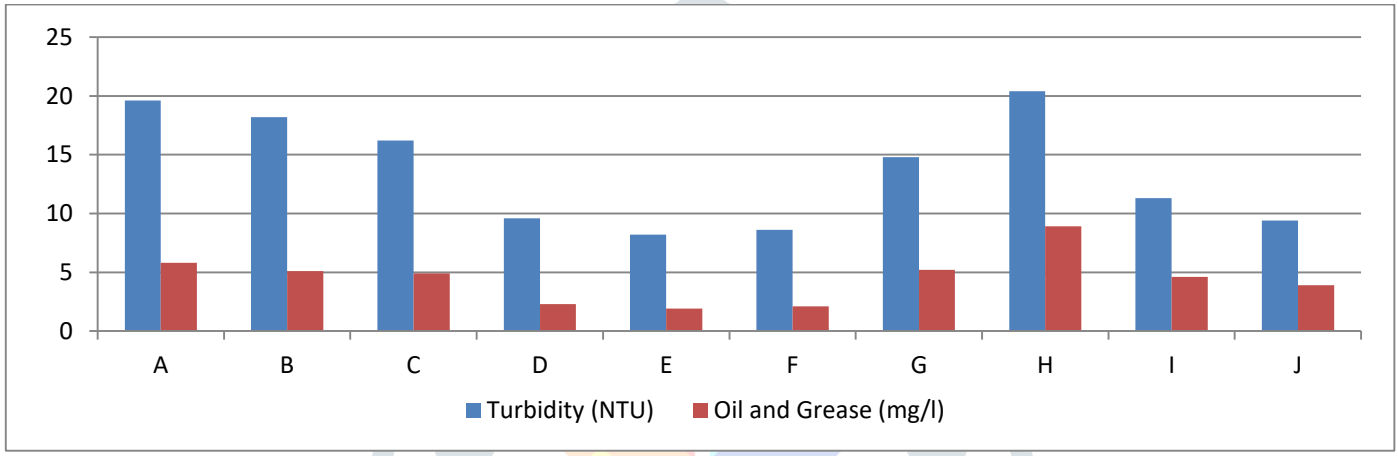
Various results of water quality analysis are as under:

PARAMETER			pH	Tempr-eture (^{0}C)	Turb-idity (NTU)	BOD (mg/l)	COD (mg/l)	Suspended solids (mg/l)	Oil and Grease (mg/l)
Limits			**5.5-9**		**10**	**30**	**250**	**100**	**10**
S.No.	**Colliery**	**Stn. Code**							
1.	Jamuna U/G Mine	A	8.13	26.2	19.6	4.4	24	130	5.8
		B	8.11	26	18.2	4.1	22	125	5.1
		C	8.16	25.8	16.2	4.0	21	116	4.9
2.	Govinda U/G Mine	D	8.19	26.6	9.6	3.0	16	40	2.3
		E	8.23	26.2	8.2	3.4	18	42	1.9
		F	8.28	26.4	8.6	3.8	19	46	2.1
3.	Amadand U/G Mine	G	8.1	25.5	14.8	3.9	20	106	5.2
4.	Amadand O/C Mine	H	7.93	26.7	20.4	4.2	23	136	8.9
5.	Bartarai U/G Mine	I	7.71	26.8	11.3	3.0	17	80	4.6
6.	Bhadra U/G Mine	J	7.93	27.2	9.4	2.9	15	60	3.9









4.Conclusion:

In JAMUNA KOTMA mining area, the exploitation activity has a long history with important impact in air, water and noise pollution. Actually, the mining activity for some perimeters may lead to the increase of groundwater level, decreased pH, increased suspended solids, increased turbidity and increased acidity. If proper care is not taken for waste control and disposal, mining activity degrades the surrounding environment. The runoff formed is usually acidic and frequently comes from areas where coal mining activities have exposed rocks containing pyrite, a sulphur-bearing mineral. This acid run-off dissolves heavy metals such as copper, lead and mercury into ground and surface water. The noise pollution caused hearing loss and affected the mental and physical health in many ways. It has also physiological effect such as increase in blood circulation rate, heart beat rate, elevated blood cholesterol and gastric secretion. The noise interfered sleep and forced the use of sleeping pills. Hence, proper care should be taken for cure and control of these unwanted pollution. Water quality from mine discharge should be properly treated first before its disposal. Whereas,Noise can be controlled through the careful selection of equipment and insulation and sound enclosures around machinery.

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