Global Journal of human social science
Geography, Geo-Sciences, Environmental Disaster Management
Volume 13 Issue 8 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-460X & Print ISSN: 0975-587X

Susceptible Development: Impact of Coal Mining on Environment in India

By Dr. Sribas Goswami
Serampore College, India

Abstract- Coal mining contributes largely towards economic development of the nation like India although it has a great impact upon the human health. It also has its impact on socio-cultural aspect of the workers and people residing in and around coal mining areas. Thus a holistic approach for taking up to mining activities, keeping in mind concerns for adjoining habitats and ecosystem, is the need of the hour. This requires identification of various sites where minerals exist and various factors ranging from appropriate angle of slope of overburden dumps, safe disposal drains, and safe techniques to various silt control structures etc. In India Coal companies are now working towards "clean coal" strategies, which aim to reduce environmental impacts.

Keywords: pollution, coal mining, development, displacement, global warming.

GJHSS-B Classification: FOR Code : 850201

SUSCEPTIBLE DEVELOPMENT IMPACT OF COAL MINING ON ENVIRONMENT IN INDIA

Strictly as per the compliance and regulations of:

Susceptible Development: Impact of Coal Mining on Environment in India

Dr. Sribas Goswami

Abstract- Coal mining contributes largely towards economic development of the nation like India although it has a great impact upon the human health. It also has its impact on socio-cultural aspect of the workers and people residing in and around coal mining areas. Thus a holistic approach for taking up to mining activities, keeping in mind concerns for adjoining habitats and ecosystem, is the need of the hour. This requires identification of various sites where minerals exist and various factors ranging from appropriate angle of slope of overburden dumps, safe disposal drains, and safe techniques to various silt control structures etc. In India Coal companies are now working towards "clean coal" strategies, which aim to reduce environmental impacts. The reduced ash contents of the washed coal increase the thermal efficiency of combustion, which in turn make a direct impact on reducing emission of pollutants. However the coal washing requires extra water and it can turn towards a pollution free society. Coal is mined by two main methods- Surface or 'opencast' and underground mining method. Geological condition determines the method of mining. Coal mining is usually associated with degradation of natural resources and destruction of habitat. This causes invasive species to occupy the area, thus posing a threat to biodiversity. Huge quantities of waste material are produced by several mining activities in the coal mining region. If proper care is not taken for waste disposal, mining degrades the environment. The method of waste disposal affects land, water and air and in turns the quality of life of the people in the adjacent areas. This paper tries to focus on the various issues of environmental pollutions in mining areas.

Keywords: pollution, coal mining, development, displacement, global warming.

I. Introduction

Coal mining contributes largely towards economic development in India although it has a great impact upon the human health. It also has its impact on socio-cultural aspect of the workers and people residing in and around coal mining areas. Thus a holistic approach for taking up to mining activities, keeping in mind concerns for adjoining habitats and ecosystem, is the need of the hour. This requires identification of various sites where minerals exist and various factors ranging from appropriate angle of slope of overburden dumps, safe disposal drains, and safe techniques to various silt control structures etc. In India Coal companies are now working towards "clean coal" strategies, which aim to reduce environmental impacts.

Author: Assistant Professor, Department of Sociology, Serampore College, West Bengal, India, PIN-712201.
e-mail: sribasgoswami@gmail.com

The reduced ash contents of the washed coal increase the thermal efficiency of combustion, which in turn make a direct impact on reducing emission of pollutants. However the coal washing requires extra water and it can turn towards a pollution free society.

Burning of coal, releases harmful substances such as sulphur dioxide, nitrogen oxides, carbon dioxide, particulates dust and ash. Dangerous levels of air and water pollution have been recorded in coal burning areas. It is globally accepted that coal mining adversely affects local and global environment. Mining adversely affects local environment in that it destroys vegetation, causes extensive soil erosion and alters microbial communities. Although coal mining does affect global environment through release of coal- bed methane, which is about 30 times as powerful as greenhouse gas as carbon dioxide. Coal mining thus adversely impacts on air quality standards. Underground mining causes depletion of groundwater at some places, as well as subsidence etc. resulting in degradation of soil and land. Subsidence of the soil beyond permissible limits requires filling of the subsidence area. The displacement and resettlement of affected people including change in culture, heritage and related features, criminal and other illicit activities on account of sudden economic development of the area can be said to be the adverse social and cultural impact.

Some of the beneficial impacts of mining projects are changes in employment pattern and income opportunity, infrastructural change and community development. Development in communication, transport, educational system, commerce, recreation and medical facilities etc. are some positive impacts. It is thus clear that coal mining leads to environmental damage, while economic development and self-reliance call for the increased mining activities of the available mineral resources. Though there is no alternative to the site of mining operations, options as to the location and technology of processing can really minimize the damage to the environment.

In this way coal mining has multi-dimensional impacts on environment directly or indirectly. The present work will be an attempt to bring into focus the impact of coal mining an environment in the Raniganj coal field region which is the command area of Eastern Coal field limited (ECL) and in the Jharia field region which is command area of Bharat Cocking coal limited (BCCL). Both are subsidiaries of Coal India limited.

II. Objectives of the Study

1. To find out the impact of coal mining on environment in Raniganj and Jharia coalfield.
2. To find out the various components of the environment related with the coal mining projects.
3. To elucidate the coal mining practice in Raniganj and Jharia coalfield.
4. To analyze the various proximate factors influencing the coal mining projects.
5. To find out the relation between the environmental condition and coal mining projects.
6. To discuss the causes and consequences of environmental degradation in the Raniganj and Jharia coalfield.
7. To discuss the various socio-economic infrastructure and environmental factors influencing the coal mining projects.
8. 8. To review the performance of Government programmes related to the coal mining Projects.
9. To highlight the policies of the coal India limited having direct bearing on Environment.
10. To observe the application of clean coal technology in various coalmines of Raniganj and Jharia.

III. Sources of Data & Methodology

The methodology of the research includes collection of research materials by field study and observation methods. The present study is based on both Primary and Secondary.

a) Primary Data

Primary data collected from:

a. *Field study:* Field study through observation method and interrogation with Management and laborers of the several collieries.
b. *Documentary facts:* Collection of day-by-day recorded information from Coal Mining Authority and unpublished information materials gathered from the office of coal mines.
c. Observation of the present condition of the several collieries during field study and also observation of coal mines (underground and opencast).

b) Secondary Data

The study mainly based on secondary data, collected from various sources like Economic and Statistical Department of E.C.L headquarters for all the Colliery related data like the manpower of concerned colliery, depth of the underground mines, location of opencast mines, record of accidents, etc.

c) Study Area

One of the important coalfield in India as well as of West Bengal, namely Raniganj coalfield has been selected for research purpose. The Raniganj coal field is bounded by latitudes 23° 35° N to 23° 55° N and longitudes 86° 45° E to 87° 20° E is the most important coalfield of West Bengal (Burdwan District) lies in the Damodar valley region is surrounded by Durgapur – Asansol Industrial belt. For empirical study, another study area of Jharkhand namely, Jharia coalfield has been selected for research purpose. The Jharia coalfield is located in the Dhanbad district of Jharkhand state at a distance of 260 km from Kolkata towards Delhi. It is bounded by latitudes 23° 38° N to 23° 52° N and longitudes 86° 08° E to 86° 29° E.

IV. A Brief Description of Raniganj and Jharia Coal Field

The total geographical area covers by both the coalfield is approximate 2300 square kilometers out of which Raniganj coal field comprises of 1630 km2 and Jharia coal field comprises of 670 km2 areas. As per the district statistical report (2010) the total population of the two coal mining belt was 6,65,300 out of the total population the working population in coal mines was 1,92,358 (C.I.L report 2010).

V. Area Wise Distribution of Mines of E.C.L. and B.C.C.L

There are total 14 area offices are present in Raniganj coal field (E.C.L) and under the area offices there are 124 collieries are coal producing unit. There are total 11 area offices are present in the Jharia coal field (B.C.C.L) and under the area offices there are 116 Collieries are coal producing Unit. List of the area Offices are given below:

Table 1 : Name of the Area Offices in E.C.L & B.C.C.L

Sl. No.	Raniganj Coal Field (E.C.L)	Jharia Coal Field (B.C.C.L)
1.	Rajmahal	Mahuda
2.	Sonepur Bazari	Barora
3.	Satgram	Govindpur
4.	Sripur	Katras
5.	Jhanjhra	Sijua
6.	Kunustaria	Kusunda
7.	Salanpur	Put ki bolihari

8.	Mugma	Kostare
9.	Kajora	Bostatola
10.	Sodepur	Lodhna – Amlabad (E.Jharia Area)
11.	Bankola	Chanch Victoria (Block L and G)
12.	Pandeshwar	
13.	Kenda	
14.	Chitra	

Source : ANGARA, a Monthly Journal of IICM, Ranchi, May 2012.

VI. Employment in Coal India Limited (Including E.C.L. & B.C.C.L)

It is observed that particularly in the employment scenario of E.C.L. and B.C.C.L. it will be clear that after the nationalization of coal mines the number of employment in coal mines gradually increased. But in present the number of employment is decreasing due to several causes. In the following table the number of working population of the C.I.L is given.

Table 2 : Manpower in Coal India Limited

Company / Subsidiary of CIL	Manpower (01-04-10)	Manpower (01.03.11)
E.C.L.	94943	90758
B.C.C.L	80051	76576
C.C.L	58808	56698
W.C.L	64160	62545
S.E.C.L	82782	81597
N.C.L.	16697	16467
N.E.C.	3072	2971
CMPDI	3048	3062
D.C.C.	641	622
C.I.L. (HQ)	1089	1069
Total	405291	392365

Source: ANGARA, a Monthly Journal of IICM, Ranchi, May 2012.

VII. Site Development and Land Use Plan in Ming Areas in India

A site development and land use plan should be prepared to encompass pre-operational, operational and post-operational phases of a mine. It should clearly indicate the planned post-operational land use of the area, with details of the measures required to achieve the intended purpose. The general survey for the purpose must take into account not only the broad features of the actual or proposed mining operations, nut also the surrounding terrain conditions. The important components of this survey include:

(i) present land use pattern of the area;
(ii) main features of the human settlements in the area;
(iii) characteristics of the local eco-system;
(iv) climate of the area;

(v) relevant terrain information that will help in waste dumping, tailings disposal, etc., with least effects on the local land-water system, including-
  (a) geo-morphological analysis (topography and drainage pattern),
  (b) Geological analysis (structural features-faults, joints, fractures, etc.),
  (c) Hydro-geological analysis (disposition of permeable formations, surface-ground water links, hydraulic parameters, etc.),
  (d) analysis of the natural soil and water to assess pollutant absorption capacity, and
  (e) availability and distribution of top-soil;

(vi) communication and transport facilities;

(vii) details concerning the mining plans-
  (a) minerals to be worked,
  (b) method of working,
  (c) details of fixed plants,
  (d) nature and quantity of wastes and disposal facilities required for them,
  (e) possibilities of subsidence and landslides,
  (f) transport facilities needed, and
  (g) Services to be installed.

An action plan for minimizing the adverse environmental impact from the proposed mining activity should be prepared. This shall also include rehabilitation of the mining area. The important aspects to be considered are:

a) Pre-Operational Phase

(i) Vegetation barriers should be raised along the contours in the hilly areas for the prevention of soil erosion and for arresting the mine wash.

(ii) Steps should be taken to construct check dams, either of rubble or brush wood, across small gullies and streams on the ore body to contain soil wash. The check dams shall be stabilized by vegetation.

(iii) The banks of streams in the mining are should be intensively vegetated to prevent the discharge of sediments into the streams.

b) Operational Phase

(i) For opencast mines, screens or banks of soil and overburden shall be constructed in the peripheral area.

(ii) Vegetation barriers shall also be constructed along the periphery of a mining area on either side of the mine/service roads and between other locations. The advantages include top-soil preservation, lessening of adverse visual impact, noise-baffling, dust suppression, etc.

(i) Clearance of vegetation should be restricted to the minimum necessary for mining operations, and planned in advance.

c) Post-Operational Phase

Once the mining operations are over, the land should be rehabilitated for productive uses like agriculture, forestry, pasturage, pisciculture, recreation, wild life habitats and sanctuaries.

VIII. Drilling and Blasting (Noise Pollution)

a) Noise Pollution In Raniganj And Jharia Coal Mines

The noise is now being recognized as a major health hazard; resulting in annoyance. Partial hearing loss and even permanent damage to the inner ear is noticed after prolonged exposure. The problem underground is of special importance because of the acoustics of the confined space. The ambient noise level of the underground mining area is affected by the operation of the cutting machines, tub/conveyor movement and blasting of the coal. The movement of coaling machines and transport units-conveyor, tubs and transfer points caused audible noise which becomes disturbing underground because of the poor absorption by the walls.

b) Noise Pollution Due To Mining Activities

The most note 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 80-1040 dB(A). In a mine of Raniganj and Jharia the noise level near fan house, conveyor system shearer and road headers was reported to be within 92-93 dB (A). The values increased in many Indian mines because of poor maintenance of the machines and exceeded the permissible limit of 90 dB (A) for 8 hours per day exposure. The result of a noise survey for a coal mine conducted by DGMS (Director general of mines safety) is summarized in the following table which indicates noise over 90 dB by the drills, breaking and crushing units and transport system underground.

Table 3: Noise level in underground coal mines

Location of survey	Average Noise level dB (A)
Near shearer	96
Transfer point	99
Tail end belt conveyor	89
Power pack pump	91
Drive head of AFC	96

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012

The mechanized mines have lower noise problem in comparison to the old conventional mines operational mines operating with haulage and coal cutting machines. The results (Table 3) covering wholly manual, partly mechanized with coal cutting machines and partly mechanized with SDL loading showed reduction in the noise level underground.

Table 4 : Noise survey in selected coal mines

Type of mine	Machine points	Noise Level	Duration of Operation
Wholly manual	Drill Tagger haulage	87dB(A) 105Db(A)	1-2 hrs 4 hrs
Mechanized with CCM cutting	CCM Drill Auxiliary fan	94Db(A) 94Db(A) 93dB(A)	1 hrs 1-2 hrs 8hrs
Mechanized loading	Drill LHD Chain conveyor	88Db(A) 98Db(A) 84Db(A)	2 hrs 4-5hrs 4-5hrs

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012

c) Noise Pollution Due To Blasting

The blasting underground cause's high frequency sub audible noise measured in terms of air over pressure. The magnitude of air pressure is found to be 164 dB (1) at 30m distance reduced to 144 dB (l) at a distance of 70m. Test results of some of the sites are summarized in the following table.

Table 5 : Air pressure due to blasting in underground mining areas

Mine name	Explosive type	Max, charge/delay Total charge Max, (kg)		Air over pressure at Distance-m Value	Db(I)
Ray	P1	kg	10.6 kg	50m	153.8
Bachra	P5	6.2 kg	2.4 kg	70m	144.5
	P3	12.5 kg	12.5 kg	154m	150.1
Girmint	P5	6.4 kg	2.5 kg	30m	164.8

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012

The total noise menace due to blasting underground is the result of the audible and sub audible noise. The sub audible noise responsible for vibration causes vibration of the surface features and in case of thin overburden cracks in surface structures. This societal reaction of Jharia Town Development Forum over blasting forced the pick mining in some of the situations. The reaction of blasting is reported in the following forms.

- Damage of old structures due to vibrations.
- Public nuisance vis-à-vis disturbance of sleep.
- Disturbance of sewerage and water supply line.

The amplitude of vibration due to blast wave was observed to be reduced with increase in the height of the building and hence drop in the level of nuisance in the upper floors. The investigation in some of the mines revealed that in case of machine cut the blasting in the lower section generated more vibration than that of the upper portion. The restriction of total charge was essential to minimize the vibration due to blasting underground. The P5 explosive generated low vibration in comparison to P3 grade of explosives.

The noise control measures in general are categorized in three groups: personal protective measures, engineering control measures and administrative measures. The engineering control measures are the most effective as they are based on sophisticated techniques like Retrofit approach for installation of noise control treatment on mining equipment. Designing of inherently quite mining equipment is also included in this technique which aims to control and reduce the noise emission successfully. The preferred cost effective system for the underground mining has been the personal protective system – ear muffs for the operator of the noise producing units.

IX. Toxic Waste Treatment

Nearly 25-35% of rain water drained back to ocean through reveres and streams; the major source of potable water for local population. Except particulate impurities (coal dust/soil/clay) and bacteriological or biological impurities; the river water was normally fit for consumption. Normal filtering and disinfectants made the water acceptable and had been used in India and elsewhere. Ground water on the other hand was not fit for consumption unless treated for hardness. The quality of mine water of Jharia and Raniganj Coalfield obtained from the underground mines are summarized in the following table.

Table 6 : Mine water quality in e.c.l & b.c.c.l

Area	**Kunustoria**	Effluent water(MOEF schedule-vi standard)
Project	Parasea UGP	
Qtrending	June 2009	
Samplining station	W1	
Date of sample	Mine discharge from pit no. 2	
Colour	9^{th} May 2009	
Orour	unobjectionable	unobjectionable
TSS	unobjectionable	unobjectionable
PH	44.00	100.00
Temperature ^{o}c	8.40	5.50-9.00
Oil & grease	Normal	Shall not exceed 5^{0}C
Total residual chlorine	<1.00	10.00
Ammonical Nitrogen	Nil	1.00
Total kjeldahi nitrogen	0.03	50.00
Free ammonia	0.76	100.00
B.O.D.	BDL	5.00
C.O.D.	-	30.00
Arsenic	40.00	250.00
Lead	<0.01	0.20
H .Chromium	<0.05	0.10
Total Chromium	0.08	0.10
Copper	0.08	2.00
Zinc	0.05	3.00
Selenium	0.02	5.00
Nickel	<0.01	0.05
Fluoride	-	3.00
Dissolved phosphate	0.46	2.00
Sulphide	-	5.00
Phenolics	0.04	2.00
Maganease	<0.001	1.00
Iron	0.22	2.00
Nitrate nitrogen	0.18	3.00

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012

Note: All parameters are in mg/l unless specified otherwise NA stands for not analyzed.

Iron	0.22	2.00
Nitrate nitrogen	0.18	3.00

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012
Note: All parameters are in mg/l unless specified otherwise NA stands for not analyzed.

The water pollution problem in the mining areas is broadly classified into the following major heads depending upon the nature of coal and dump, effluents and rock formation:

- Acid mine drainage in case of high sulfur coal
- Eutrophication and Deoxygenating due troth of algae because of sulfur.
- Heavy metal pollution

High level of dissolved solids such as bicarbonates, chlorides and sulfates of sodium calcium, magnesium, iron and manganese are introduced to water while passing through aquifuge and aquiclude made permeable due to sagging and industrial usage without treatment. This makes the water hard, unfit for drinking, other impurities in a few selected mines of Jharia and Raniganj coalfield. Low level nitrates and phosphates served as nutrients to algae; rapid growth of which caused deoxygenating of water, and lowering of dissolved oxygen. This was likely to occur when the underground water was accumulated in water pools. Use of such water for irrigation might improve production and yield of crop.

a) Acid Mine Drainage

Breaking of coal and leaching of pyrite of sulfur content from the coal and surrounding formation lead to acid mine drainage; a problem known world over. Oozing out of yellow sludge, smell of H2S and increase in pH value were some of the physical symptoms of the Acid Mine Drainage (AMD). The corrosion of impeller of the pumps, pitting or whole development in the steel pipes and loss of aquatic life were the other impacts of AMD. This problem was mainly in the North Eastern Coalfield of Assam, Arunachal Pradesh and Jammu & Kashmir and somewhere in Raniganj and Jharia coal field also.

Average sulfur content of the coal of Gondwana stage is below 1% which increased to as 8% in Jharia Coalfield; average being within 3.5%. The sulfur content of semi-anthracite deposits of Raniganj is even higher, up to 9%. The sulfur in coal deposits of this region is organic as well as pyretic in nature. The organic sulfur was structurally bound in coal and is difficult to separate, wash or drain. Pyretic sulfur on the other hand is present as intrusion in the coal seams and immediate formation around in form of balls –circular or elliptical mass or fine dispersed particles. These tiny particles were mainly responsible for the acid mine drainage. Crushed pillars, caved coal band, intrusive rocks and lift over coal dust were subjected to leaching when the aquifer or aquiclude drained down due to secondary permeability of the interburden. Under the influence of seeping water, the pyrite (Fe SO2) was oxidized, forming sulfuric acid. As a result, pH value of the water increased, making it unfit for normal consumption and industrial use.

a) Heavy Metal Pollution

Heavy metals like lead, zinc, arsenic and cadmium were detected in traces in the mine water, mainly because of leaching of aquifuge, aquiclude and igneous intrusions and effluent of oil and grease from the machines underground. The toxic substances generally in the confined state within the rock mass were exposed to dynamic setting of soil water system when they start polluting mine water. The list of the toxic elements and their impact is summarized as follows:

Table 7 : Toxic trace elements and their impact

Element	Impact/Effect
As	Toxic, possibly carcinogenic
Cd	Hypertension, kidney damage &
Be	toxic to biotic
B	Acute toxicity, possibly
Cu	carcinogenic
Fl	Toxic to plants
pH	Toxic to plants and algae
Mn	Cause mottled teeth Toxic (Anemia, Kidney disease, nervous disorder) Toxic to plants

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012

Some of these elements served as nutrient to plants and aquatic life at lower concentration. There concentration in coal mine water was normally within permitted limit and required no special treatment. The survey result of two mines of Raniganj coalfield is summarized in the following table.

Table 8 : micro elements in bonjemihary & GHANSHYAAM MINES

Micro elements Cmol (P+) kg	Benjemihary	Ghanshyaan
Ca	0.78	51.0
Fe	0.51	0.89
Al	0.49	0.68
Mn	0.09	0.14
Zn	0.11	0.08
Mo	0.02	0.02
Cu	0.02	0.005
Bu	0.02	0.02

Sources: Coal Mining Planning and Design Institute,Survey Report, 2012
*Results in ppm.

The presence of a large number of trace elements in coal was attributed to species of carbonaceous swamps or contemporaneous sedimentation with holmic acids solubilizing and binding these elements. Trace elements might have come through inflowing these element might have come through inflowing ground water during calcification. The magma tic and fluid might have resulted epigenetic mineralization and enrichment of trace metals. The elements like. As, Cd, Hg, Pb and Zn were the inorganic fraction of coal while Cr, Cu and Sb were present in mineral and organic from. The concentration of trace elements in Raniganj and Jharia coalfield is summarized below.

In the process of mining these elements were released or mixed to the inflowing water and ultimately to water channel.

Table 9 : Concentrations of trace elements in coal

Element	Concentration (μg / g^{-1}) of Trace Elements in Regions			
	Kunustoria	Parasia	Katras	Victoria
Antimony	1.35	-	3.5	3.33
Arsenic	14.9	4.8	6.8	16.8
Cadmium	2.89	0.2	-	0.2
Chromium	14.1	12.7	17.5	31.9
Fluorine	59.3	54.0	-	-
Lead	39.8	0.8	-	21.7
Mercury	0.21	0.07	0.42	0.22
Barium	113.8	146.0	-	21.7
Nickel	22.4	5.5	-	-

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012.

b) Water Regime Disturbance

Disturbance of lithosphere, yield and movement of ground water, dewatering of the workings and recharging of overburden formation were the interrelated operation of underground mining. Dewatering from underground, recharging from rainwater precipitation and inflow of surface water were complimentary to each other. With the formation of depression fissures, even the aquifuge started draining across and cone of depression extended for and wide out of the area of influence.

Settlement of the ground with water drainage induced additional cracks and fissures over the surface. As a result, the rate of precipitation increased when higher percentage of rain and surface water infiltrated down ward; raising overall water table. Furthermore, in place of a few confined aquifers, extensive unconfined/ leaky aquifers were formed with the ground movement.

The water starting from precipitation traveled overland, adopted through flow, interflow and base flow leading to basin channel flow and a part retained in aquifers. With the creation of voids underground; percolation through mine roof and walls and ultimately flow with the failure of confining beds occur. The water accumulated in the mine is pumped back to surface. Mine water pumped from the working face contained 1500-1600 mg/1 suspended impurities, mainly coal dust, particles and salts of calcium, magnesium and iron. The concentration of suspended impurities dropped slowly in sumps formed underground. With the filling of cracks by silts or clay particles during rainy season, the overburden character was restored with time when water pools were formed on the surface in the subsidence trough and given opportunity, flora and fauna congenial to climate and surroundings developed with better result. On the other hand, undulation of ground disturbed the channel of streams or rivers, bringing larger area under high flood level of the streams. Unless taken care, the river water flowed down through fracture planes, flooding the working. Depending upon thickness of the burden and the working seams, the fractures became open channel or was sealed with silting. Loss of stream or formation of water pool was the two extremes of the phenomena.

Quality of water, however, was the main casualty of the scenario when hardness of the water increased up to 700 mg/l inclusive of 300-500 mg/l permanent hardness which necessitated special treatment. The other impurities like heavy metals and oxygen balance of the underground water in most of the Indian coalfields were well within the accepted limit.

The ground movement impact on hydrosphere was manifested in the form of increased storage and charging character, lowering and disturbance of the water table, loss of streams or water pools. Some of them improved the water availability to the flora and fauna and biomass in general and improved the environment and ecology while a few caused temporary damage to the environment and ecology with the development of the fracture planes and opening of the cracks. The positive impact of the ground movement over the hydraulic regime was however, diluted due to repeated mining of the seams one after the other. With each seam working, the cycle of negative impact was repeated, water table lowered and level of pollution increased time and again. It takes time – a couple of years again before the regime were restored to normalcy.

c) Illegal Coal Mining

Coal occurs so close to the surface in many areas of Raniganj and Jharia Coal field, particularly in the context of a stagnant agricultural sector, to dig it out is irresistible. Any tool is used for this purpose-mostly ranging in variety and complexity from the traditional ones to comparatively more efficient, modern equipment. A near vertical hole on the ground leads to a labyrinth of tunnels which are sometimes only high enough to hold a squatting man. These rat-holes may occur anywhere in the region and have opened up a new, albeit illegal, avenue of informal employment. Many abandoned uneconomic mines of ECL- and BCCL both underground and opencast are also thriving as illegal mining sites.

Thus mines have often been called 'state run private enterprises' as few adequate steps have been taken to curb the malpractice. These mines have become sheer death traps where unplanned coal exploitation and subsequent roof falls result in loss of lives of many illegal mines, most of which go unreported. Illegal Mining is a common feature in most of the coal mining areas. In Raniganj and Jharia coal mines region it is not an exception. In these regions the young unemployed persons are generally engaged in illegal coal mining.

According to the author, Illegal Mining can be defined as, "Unethical and illogical cutting of coal seams beneath the earth surface without the prior permission of the coal mining authority". In the coal bearing land it is the easiest way to earn some money rapidly. In this process many big holes are made on the earth surface like a 'rat-hole' to cat the shallow coal seams. Another process is cutting the coal seams from the abandoned mines, Illegal miners are simply dugout the coal seams and sell the huge amount of coal in the local market through 'Coal Mafia' and earn a healthy price. The author has visited many places of Raniganj and Jharia coal mining belt to observe the illegal mining process. Local police authority is not in sound to protect the illegal mining process. A healthy amount is always goes to their pocket and they are mute listeners in this care.

X. Some Negative Impacts of Illegal Mining on Environment

1. In this process of mining there are unscientific cutting of shallow coal seams, which often causes disorder in the surface of the mining region.
2. This type of mining causes huge removal of top soil and it causes soil erosion.
3. Where the mining activities are going on there is total destruction of vegetation cover in that region.
4. Due to illegal mining there is a massive dust and noise pollution occurred in the surrounding area.

5. Due to unscientific cutting of coal seam there is a destruction of coal reserve in coal mining belt.
6. Due to illegal mining there is always chance of land subsidence.
7. Due to mismanagement and natural heating sometimes fires may cause in illegal mines, which results into huge emission of noxious gases and burning of Coal seams.
8. After cutting of coal seams illegal miners left all the mines in the lap of nature. So, the whole region is converted into an abandoned field.

XI. Illegal Coal Business in Raniganj and Jharia Coalfield

There is no proper legal documentary facts or data are available related to illegal coal mining business, but as per some personal survey and confidential report there is maximum transaction of illegal coal must be exceed Rs.8 billion per annum. Out of this huge amount the business of Rs.3.50 billion comes from CCL and Rs.4.50 billion comes from ECL and BCCL area.

According to some sources, the free trade of illegal coal occurs in a massive way in RCF and JCF region. Per day approximate 500 truck of coal are dispatched to hard coke, sponge iron factories, brick industries and different part of the country. It is estimated that, per day 300 trucks of coal from Dhanbad region and 200 truck of coal from Jharia, Raniganj and Bokaro region dispatched to the market.

The quantity of coal per truck is 20 tons and the price of this amount of coal is Rs. 60,000 per truck. In this way the business of illegal coal is approximate more than Rs.3 billion per day. In this coal mining region the illegal coal business continues up to 9 months in a year. During these 9 months approximate 1.35 million truck coal is extracted from illegal mines. The total amount of coal business continues up to Rs .8 billion in a year.

Per day illegal coal production-500 truck (per truck 20 tons)

Coal production in 9 months-500 × 270= 1.35 million truck

In market value of per truck coal- Rs.60, 000

Per annum business of illegal coal-1.35 million truck × 60,000=8.10 billion

Fixed amount from 1 truck coal:

Value of coal-20,000 Rs.

Police-10,000 Rs.

Terrorists-5,000-6.000 Rs.

Fare of truck-15,000-20,000 Rs.

Amount of the coal marchent-5,000-10,000 Rs.

Many local people also engaged in this illegal coal business. Generally they are supported by local coal mafia and local police authority. Local people use their bi-cycle, bullock-cart, rickshaw-van etc. to dispatch by illegal coal to local market. In this way they earned a healthy price from this illegal business. Many complains are made to the local police station to stop Illegal coal mining by the local people .But the police authority is sleeping in this matter.

a) *The Region Of Illegal Mining*

Jharia region- Mohuda, Bhatdih, Murlidih, Gobindpur, Tetulia, Katras, Kusunda, Kustaur, Lodhna, Mourigram, Sudamdih etc.

Raniganj region- Jamuria, Mejia, Satgram, Sripur, Sonepur bazari, Mahavir colliery, Kunustoria area etc.

b) *Laws To Curb Illegal Mining*

In order to curb illegal mining and rampant smuggling of major minerals, the state government has formulated Jharkhand Minerals Dealers' Rules (JMDR-2007) to check the menace.

The state cabinet while approving the Mineral Dealers' Rules-2007 strongly felt that the there are a large number of dealers operating without any proper record or registration with the mines and minerals department. Hence the government decided to make the registration of operating dealers mandatory with the department concerned. This will put a spanner on illegal marketing and smuggling of major minerals like iron ore, bauxite etc, said the secretary, mines, Jaishankar Tiwary. The state government he said is unable to cross check the minerals stocked or stored at any place.

Those dealing in minerals had the plea that they paid off the royalty at the mining site and have stored the stock at some other place for transportation. The government also felt the need of cross checking and verification of minerals, as there is no provision available under the Central Government Mines and Minerals Development Act (MMDR), 1957.

However, the Centre has given ample scope to prepare the rule as per its requirement for checking and verification of account. With the new rule, JMDR-2007 to be brought into effect soon, the mines and minerals department will be able to verify the stock at any given point of time.

Officials said once the registration of the dealers is done, the department concerned will issue the license to the party. After this, the party will be able to purchase and stock the major minerals. The modus operandi also includes the dispatch receipt from the district mining officer (DMO) from the place of transportation of the minerals. According to the director, mines, B.B. Singh, illegal mining in the state is wide spread, thereby causing huge losses running in several cores to the state exchequer. The department is flooded with such complaints and the target of revenue collection of the department is difficult to achieve.

Hence the legal wing of the department thought it necessary to formulate the rule to put a check on smuggling of major minerals.

XII. Concluding Observations

Mining has a significant impact on the economic, social and environmental fabric of adjoining areas. Although mining activities bring about economic development in the area at the same time the land degradation it causes creates ecological and socio-economic problems.

Mining adversely affects the eco-system as a whole. It is important to conduct suitable assessment studies to learn the potential adverse impact of mining or flora and fauna. The adverse impact should be identified at the planning stage itself so that corrective measures may be taken in advance.

To overcome from the problems one should have knowledge about the various activities of environmental concern. Every mine manager should keep a check list giving information on environmental controls, as envisaged in various mining lease conditions of the Government of India and Environment management plan. Frequent review of this information may enable identification of the site-specific environmental issues at the mine. Poor environmental performance may accelerate the demands for mere stringent regulatory conditions. The adverse effects of subsidence fissures have made most of the subsided areas barren and unstable. The indirect effect of subsidence has contributed to drying up of many tanks and dug wells in the vicinity. Much of these subsided land may however be put back to productive use with joint effort from coal companies and local bodies, but no concerted and coherent effort has however been taken in this direction. Not much study has been done towards reclamation of subsided land in Indian coalfields. In a few areas of Raniganj coalfield including Ninga and Sripur, plantation on subsided land has been tried. The scientists are of the opinion that before starting reclamation of subsided land, the purpose of reclamation in terms of "land-use" should be decided in consultation with the local people. The most important thing is to plug the cracks and it may not be necessary to bring the subsided land to original profile even for use for agriculture, plantation and housing. Some researchers are, however, badly needed for improving water retaining capacity of subsoil in the subsided land. There is no specific legislation in India concerning subsidence, but as per common law, the coal company is to acquire the surface right of the property in which subsidence may occur due to underground mining. In some countries, there are specific legislation guiding the coal industry in matters of subsidence and perhaps such enactment may be the necessity of the day in our country also.

References Références Referencias

1. Agarwal. A and Narain. S. (1991), "Global warming in an unequal World" International Sustainable Development. Vol.1. Oct. pp. 98-104.
2. Bagchi. A and Gupta, R.N. (1990), "Surface blasting and its impact on environment", Workshop on Environmental Management of Mining Operations, Varanasi, pp.262 -279.
3. Biswas, A.K and Agarwal, S.B.C. (1992). "Environmental Impact Assessment for Developing countries": Butterworth aeinemann Ltd. Oxford, pp.249.
4. Bose, A.K.and Singh, B. (1989). "Environmental Problem in coal Mining areas, Impact assessment and Management strategies- case study in India": vol-4, pp.243.
5. Ghose, K. M. (2004), "Effect of opencast mining on soil fertility" Centre of mining environment, I.S.M, Dhanbad, India.
6. Saxena N.C., Singh, G. and Ghosh, R. (2000): "Environment Management in mining areas", Centre of mining environment, I.S.M., Dhanbad, India.
7. Rao, D.N. (1971) "Air pollution and plant life": Department of Environment, London.
8. Singh, G. (2005). "Water sustainability through augmentation of underground pumped out water for portable purpose from coalmines of Eastern India": Indian School of Mines, Dhanbad. India.
9. Walsh, Fiona and Wood C. (1991). "The Environmental Assessment of opencast coal mines": Occasional Paper 28, Department of Planning and Landscape, University of Manchester, U.K.
10. Wathern, P. (1988). "An introductory guide to EIA in: Environmental impacts assessments (2nd ed.), London, U.K, pp.3-28.