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Impact of Coal Mining on Environment

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Abstract

Coal mining adversely affects the eco-system as a whole. On the unstable earth, the unresting mankind constantly uses a variety of resources for daily lives. Coal is recognized to have been the main source of energy in India for many decades and contributes to nearly 27 % of the world's commercial energy requirement. Coal is mainly mined using two methods- surface or 'opencast' and underground mining. The geological condition determines the method of mining. Coal mining is usually associated with the degradation of natural resources and the 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 will degrade the surrounding 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 throws lights on the burning issues of coal mines and its impact on the environment.

Keywords: coal mining; development; displacement; explosive; pollution.

Introduction

Mining activity puts tremendous pressure on local flora and fauna, particularly where diversion of forest land for mining takes place. The effect of mining on ground water level, silting of surrounding water bodies and land are also of great concern. Coal mining contributes greatly towards the economic development of the nation, although it also has a great impact upon human health. It also has an impact on socio-cultural aspect of the workers and people residing in and around the coal mining areas. Thus, a holistic approach to mining activities, keeping in mind the concerns regarding the local habitats and ecosystem is necessary. This requires identification of various sites where minerals exist as well as various other factors ranging from an appropriate angle of slope of the overburden dumps, safe disposal drains, and safe techniques for various silt control structures etc. In India, Coal companies are now working towards "clean coal" strategies, which aim to reduce the environmental impact. The reduced ash contents of the washed coal increases the thermal efficiency of combustion. This has a direct impact on reducing emission of pollutants. The coal washing process requires extra water, but it can help us progress towards a pollution free society.

The burning of coal releases harmful substances such as sulphur dioxide, nitrogen oxide, carbon dioxide, as well as particulates of 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 the local and global environment. Mining adversely affects the local environment in that it destroys vegetation, causes extensive soil erosion and alters microbial communities. Coal mining also affects the global environment through the release of coal bed methane, which is about 30 times as powerful a greenhouse gas as carbon dioxide. Coal mining thus adversely impacts air quality standards (Agarwal, 1991). Underground mining causes a depletion of groundwater in many 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 a change in the culture, heritage and related features, as well as a rise in 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 include changes in employment patterns and income opportunities, infrastructural changes and community development. Development in communication, transport, the educational system, commerce, recreation and medical facilities etc. are some of the positive impacts. It is thus clear that coal mining leads to environmental damage, but there are also positives regarding economic development as well as greater self-reliance through increased mining of the available mineral resources. Though there is no alternative site for the 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 the environment both directly or indirectly. The present work is an attempt to bring into focus the impact of coal mining on the environment in the *Raniganj* coal field region which is the command area of Eastern Coalfields Limited (ECL) and in the *Jharia* field region which is command area of Bharat Coking Coal Limited (BCCL). Both are subsidiaries of Coal India limited.

Sources of data & methodology:

The present study is an empirical research conducted in two major coalfields namely Raniganj Coalfields and Jharia Coalfields in India. The methodology of this study includes the collection of research materials through field study and observational methods. The present study is based on both Primary and Secondary data.

Study area:

One of the most important coalfields in India as well as in West Bengal namely *Raniganj* coalfield, has been selected for this research. The *Raniganj* coalfield 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 in West Bengal (Burdwan District), and lies in the *Damodar* valley region surrounded by the *Durgapur-Asansol* Industrial belt. For empirical study, another study area in Jharkhand, namely *Jharia* coalfield, has been selected for this research .The *Jharia* coalfield is located in the *Dhanbad* district of Jharkhand state at a distance of 260km 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.

Results and discussions:

1. Site development and land use plan in coal mining area:

A site development and land use plan should be prepared to encompass the 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 this purpose must take into account not only the broad features of the actual or proposed mining operations, but also the surrounding terrain conditions. The important components of this survey include:

(i) Present land usage 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 the 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 the rehabilitation of the mining area. These important aspects to be considered are:

1. a Pre-operational phase:

(i) Vegetation barriers should be raised along the contours in the hilly areas to prevent 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 the soil wash. The check dams shall be stabilized by vegetation.
(iii) The banks of streams in the mining areas should be intensively vegetated to prevent the discharge of sediment into the streams.

1. 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, the lessening of adverse visual impacts, noise-baffling, dust suppression, etc.
(i) Clearance of vegetation should be restricted to the minimum necessary for mining operations, and planned in advance.

1. c Post-operational phase:

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

2. Drilling and blasting (noise pollution):

2. a Nose pollution in the Raniganj and Jharia coal mines:

Noise pollution is now being recognized as a major health hazard; as well as being an annoyance. Effects include partial hearing loss and even permanent damage to the inner ear after prolonged exposure. The problem with underground mining is of particular concern because of the acoustics within 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 the transport unit-conveyor, tubs and transfer points causes audible noise which becomes all the more troublesome underground because of the poor absorption of the walls.

2.b Noise pollution due to mining activities:

The most noise-generating equipment underground are the haulage, ventilators-main, auxiliary and forcing fans, conveyor transfer points, cutting and drilling machines (Rao, 1971). The ambient noise level due to different operations in underground mines vary within 80-1040 dB (A).In a mine in *Raniganj* and *Jharia,* the noise level near the fan house, conveyor system shearer and road headers is reported to be within 92-93 dB (A). The values increases in many mines because of poor maintenance of the machines and exceeds the permissible limit of 90 dB (A) for 8 hours per day of exposure. The result of a noise survey for one of the coal mines conducted by DGMS (Director General of Mine 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 1: Noise level in underground coal mines

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

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

The mechanized mines produce lower noise pollution compared with the old conventional mines, mines operating with haulage and coal cutting machines. The results (Table 2) covering wholly manual, partly mechanized with coal cutting machines and partly mechanized with SDL loading show a reduction in the underground noise.

Table 2: noise survey in selected coal mines

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

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

2.c Noise pollution due to blasting:

Underground blasting causes 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 a 30m distance

* Db- The decibel

† CCM- Carousel Cutting Machine

‡ LHD- Large Height Deviation

reduced to 144 dB (l) at a distance of 70m. The test results of some of the sites are summarized in the following table.

Table 3: Air pressure due to blasting in underground

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

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

The total noise pollution due to underground blasting is the result of the audible and sub audible noise. The sub audible noise is responsible for vibrations in the surface features and cases of thin overburden cracks in surface structures can be observed. The societal reaction of Jharia Town Development Forum over blasting forced pick mining in some of the situations. The impacts of the blasting are as follows.

- 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 vibrations due to the blast waves is observed to be reduced with an increase in the height of the building and hence a drop in the level of nuisance in the upper floors. Investigation of some mines reveals that in cases where machines cut the blasting in the lower section in underground, it generates more vibration than that of the upper section. The restriction of total charge is essential to minimize the vibration due to underground blasting. The P5 explosive generates low vibrations compared with the P3 grade of explosives (Downing, 2002).

The noise control measures in general are categorized into 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 such as a Retrofit approach for the installation of noise control treatment on mining equipment. Designing inherently quiet mining equipment is also included in this technique which aims to control and reduce noise emission. 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 (Walsh, 1991).

3. Toxic waste treatment for water in mining areas:

Research reveals that nearly 25-35% of rain water is drained back to ocean through rivers and streams; which are major sources of portable water for population (Bagchi, 1990). With the exception of particle impurities (coal dust/soil/clay) and bacteriological or biological impurities; the river water is generally fit for consumption. Normal filtering and disinfectant makes the water acceptable and has been used both in coal mining regions and elsewhere. On the other hand, the ground water is not fit for consumption unless treated for hardness. The quality of mine water in the *Jharia* and *Raniganj* coalfields obtained from the underground mines are summarized in the following table.

Table 4: Mine water quality in Raniganj coalfields

Area	**Kunustoria**	**Effluent water(MOEF schedule-vi standard)**
Project	**Parasea UGP**	
Qtrending	June 2012	
Samplining station	W1	
Date of sample	Mine discharge from pit no. 2	
Colour	9th May 2012	
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^{o}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.

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

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

A high level of dissolved solids such as Bicarbonates, Chlorides and Sulphur of Sodium Calcium, Magnesium, Iron and Manganese are introduced into water while passing through aquifuge and aquiclude which are made permeable due to sagging and industrial usage without treatment (Wathern, 1988). This makes the water hard, unfit for drinking, as well as other impurities in a few selected mines of *Jharia* and *Raniganj* coalfield. Low level Nitrates and

Phosphates serves as nutrients to algae; rapid growth of which causes deoxygenating of water and the lowering of dissolved oxygen. This is likely to occur when the underground water is accumulated in water pools. Use of such water for irrigation might improve production and crop yields.

3.a Acid mine drainage:

Breaking of coal and leaching pyrite of sulphur content from the coal and surrounding formation leads to Acid Mine Drainage (AMD); a problem known worldwide. Oozing out of yellow sludge, the smell of H_2S and an increase in the pH value are some of the physical symptoms of the AMD. The corrosion of the impeller of the pumps, pitting or hole development in the steel pipes and the loss of aquatic life are the other impacts of AMD. This problem is mainly in the North Eastern Coalfields of Assam, Arunachal Pradesh and Jammu & Kashmir and in the *Raniganj* and *Jharia* coalfields also (Biswas, 1992).

The average sulphur content of the coal in the *Gondwana* stage was below 1 %, which has been increased to as 8 % in the *Jharia* Coalfield; the average being within 3.5 %. The sulphur content of the semi-anthracite deposits of *Raniganj* is even higher, up to 9 % (Ghose, 2004). The sulphurin in the coal deposits of this region are organic as well as pyretic in nature. The organic sulphuris structurally bound in coal and is difficult to separate, wash or drain. On the other hand, pyretic sulphuris present as an intrusion in the coal seams and the immediate vicinity in the form of balls –circular or elliptical mass or fine, dispersed particles. These tiny particles are mainly responsible for the acid mine drainage. Crushed pillars, caved coal bands, intrusive rocks and left-over coal dusts are subjected to leeching when the aquifer or aquiclude drains down due to the secondary permeability of the interbred. Under the influence of seeping water, the pyrite (Fe, SO_2) is oxidized, forming sulfuric acid. As a result, the pH value of the water is increased, making it unfit for normal consumption and industrial use (Goswami, 2013).

3.b Heavy metal pollution:

Traces of heavy metal such as Lead, Zinc, Arsenic and Cadmium are detected in the mine water, mainly because of leeching of aquifuge, aquiclude and igneous intrusions and effluent of oil and grease from the machines underground. The toxic substances are generally confined within the rock mass which are exposed to the dynamic setting of the soil water system and thus pollutes the mine water. The list of the toxic elements and their impact is summarized as follows:

Table 5: Toxic trace elements and their area wise impact

Sl.no	Element	Area 1	Area 2	Area 3
1	F_e	5.67-13.33	4.38-14.29	5.12-14.92
2	M_n	0.128-.493	0.143-.682	0.148-0.801
3	P_b	0.136-.581	0.148-.623	0.125-.712
4	C_d	0.028-.067	0.018-.073	0.021-.061
5	C_u	0.281-.489	0.362-.521	0.302-.621
6	Z_n	1.32-1.52	0.920-1.203	0.822-1.008

Sources: Coal Mining Planning and Design Institute, Survey Report, 2012
Note: All parameters are in mg/l unless specified otherwise

Some of the above elements serve as nutrients to plant and aquatic life at lower concentration. The concentration in the coal mine water is normally within permitted limit and required no special treatment. The high presence of F_e can be observed in the water and C_u is also found high in the water which is .281 to .621 in all areas.

The survey result of two mines of *Raniganj* coalfield is summarized in the following table.

Table 6: Micro elements in Bonjemihary & Ghanshyaam mines

Micro elements Coml. (P+) kg	Benjemihary*	Ghanshyaan*
C_a	0.02	51.0
Fe	0.03	0.89
A_l	0.04	0.68
M_n	0.05	0.14
Zn	0.06	0.08
M_o	0.07	0.02
C_u	0.02	0.05
B_u	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 the coal is attributed to species of carbonaceous swamps or contemporaneous sedimentation with holmic acids soluble and binding these elements. Trace elements might have come through inflowing ground water during calcification. The magma tic and fluid might have resulted in epigenetic mineralization and enrichment of trace metals. Elements such as A_s, C_d, H_g, Pb and Z_n are the inorganic fraction of coal while C_r, C_u and S_b are present in mineral and organic from.

The concentration of trace elements in *Raniganj* and *Jharia* coalfields are summarized below. In the process of mining, these elements are released or mixed to the inflowing water and ultimately to the water channel.

Table 7: 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

3.c Water regime disturbance in mining areas:

The disturbance of lithosphere, yield and movement of ground water, dewatering of the workings and the recharging of overburden formation are the interrelated operations of underground mining. Dewatering from underground, recharging from rainwater precipitation and an inflow of surface water are complimentary to each other. With the formation of depression fissures, even the aquifuge starts draining across and a cone-like depression extends far and wide out of the area of influence.

The implementation in the ground of water drainage induces additional cracks and fissures over the surface. As a result, the rate of precipitation increases when higher percentages of rain and surface water infiltrate downwards; raising the overall water table. Furthermore, in place of a few confined aquifers, extensive unconfined/leaky aquifers are formed with the ground movement (Singh, 2005).

Starting from precipitation, the water travels overland, adopts through flow, interflow and base flow leading to the basin channel flow and is partially retained in the aquifers. With the creation of underground voids; there is percolation through mine roofs and walls and ultimately flows with the failure of confining beds occurring. The water accumulated in the mine is pumped back to surface. Mine water is pumped from the working face contained 1500-1600 mg/1 of suspended impurities, mainly coal dust, particles and Salts of Calcium, Magnesium and Iron (Goswami, 2013). The concentration of suspended impurities drops slowly in slumps from underground. With the filling of cracks by silt or clay particles during the rainy season, the overburden character is restored with time when water pools are formed on the surface, and subsides through. As a result, flora and fauna congenial to climate and surroundings develops with better results. On the other hand, the undulation of ground disturbs the channel of streams and rivers, bringing a larger area under the high flood level of the streams. Unless care is taken, the river water would flow down through fracture planes, flooding the workings. Depending upon thickness of the burden and the working seams, the fractures have become open channels or are sealed with silting. Loss of streams or the formation of water pools are the two extremes of the phenomena (Bose, 1989).

Quality of water, however, is the main issue, where hardness of the water increases up to 700 mg/l inclusive of 300-500 mg/l permanent hardness which necessitates special treatment (Nish, 2012). The other impurities such as heavy metals and the oxygen balance of the underground water in most of the Indian coalfields are well within the accepted limit.

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

4. Illegal coal mining in Raniganj and Jharia coalfields:

Coal is often very close to the surface in many areas of the *Raniganj* and *Jharia* coalfields, particularly in the context of the stagnant agricultural sector, that to dig it out is very simple. Many tools can be used for this purpose-ranging in variety and complexity from the traditional to comparatively more efficient, modern equipment. A near vertical hole in the ground leads to a labyrinth of tunnels which are sometimes only high enough for a person when crouched. These rat-holes often occur all over the region and have opened up new, albeit illegal, avenues of informal employment. Many abandoned uneconomic mines of ECL (Eastern Coalfields Ltd) and BCCL (Bharat Coking Coalfields Ltd), both underground and opencast, are thriving as illegal mining sites (Goswami, 2014).

These mines have often been referred to as 'state run private enterprises' (Penz, 2011) as few adequate steps have been taken to curb the malpractice. These mines have become death traps where unplanned coal exploitation and subsequent roof collapses result in loss of lives in many illegal mines, most of which go unreported. Illegal mining is a common feature in most of the coal mining areas. The *Raniganj* and *Jharia* coalmine regions are not an exception. In these regions, young unemployed people often engage in illegal coal mining.

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" (Saxena, 2000). In the coal bearing land, it is the easiest way to earn money quickly. In this process, many large holes are cut into the earth's surface like a 'rat-hole' to catch the shallow coal seams (Madwbwe, 2011). Another process involves cutting the coal seams from abandoned mines, illegal miners are simply dig out the coal seams and sell a huge amount of coal in the local market through the 'Coal *Mafia'* and earn a healthy profit. The author has visited many places in the *Raniganj* and *Jharia* coal mining belt to observe the illegal mining process. The local police authority is not effective to prevent the illegal mining.

4. a Some negative impacts of illegal coal mining on environment:-

1. In this process of mining there are unscientific cuttings of shallow coal seams, which often cause problems on the surface of the mining region.
2. This type of mining results in huge removal of top soil and also causes soil erosion.
3. Where the mining activities are taking place, there is total destruction of vegetation cover in that region.
4. Due to the illegal mining, there is massive dust and noise pollution in the surrounding area.
5. Due to the unscientific cutting of the coal seam, there is a destruction of the coal reserves in coal mining belt.
6. Due to the illegal mining, there is always a chance of land subsidence.
7. Due to the mismanagement and natural heating, sometimes fires may occur in illegal mines, which results in huge emission of noxious gases and burning of Coal seams.
8. After the cutting of coal seams, illegal miners leave all the mines open to nature. So, the whole region is converted into an abandoned field.

Many local people are also engaged in this illegal coal business. Often, they are supported by the local coal mafia and local police authority. Local people use their bicycle, bullock cart, rickshaw van etc. to transport the illegal coal to the local market. In this way, they earn a healthy profit from this illegal business. Many complaints are made to the local police station to stop the illegal coal mining by the local people, but the police ignore it.

4.b The region of illegal coal mining:

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

Raniganj region - *Jamuria, Mejia, Satgram, Sripur, Sonepurbazari, Mahavir colliery, Kunustoria* area etc.

4.c Laws to curb illegal mining:

In order to curb the illegal mining and rampant smuggling of major minerals, the State Government has formulated the Jharkhand Minerals Dealers' Rules (JMDR-2007) to monitor the issue.

The state cabinet, while approving the Mineral Dealers' Rules-2007, found that that there are a large number of dealers operating without any proper records 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 in the works for the illegal marketing and smuggling of major minerals like iron ore, bauxite etc., according to the secretary. The state government has said it is unable to cross-check the minerals stocked or stored. Those dealing in minerals claim that they paid the royalty at the mining site and have stored the stock at some other place for transportation. The Government also recommended the cross-checking and verification of minerals, as there is no provision available under the Central Government Mines and Minerals Development Act (MMDR), 1957.

The Central Government 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 claim that once the registration of the dealers is completed, the department concerned will issue a 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 local authority illegal mining in the state is widespread, thereby causing huge losses running in several cores to the state exchequer (Mathur, 2008). The department is flooded with such complaints and the revenue collection targets of the department are difficult to achieve.

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

Conclusion

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, it also causes land degradation that creates ecological and socio-economic problems.

Mining adversely affects the eco-system as a whole. It is important to conduct suitable assessments to understand the potential adverse impact of mining on flora and fauna. The adverse impact should be identified at the planning stage itself so that corrective measures may be taken in advance (McDowell, 1996).

To overcome the problems, one should be aware of the various activities that are of concern regarding the environment. Every mine manager should keep a checklist giving information on environmental controls, as envisaged in the 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 more stringent regulations. The adverse effects of subsidence fissures have made most of the subsided areas barren and unstable. The indirect effect of subsidence has contributed to the drying up of many tanks and dug wells in the vicinity. Much of this subsided land may however be put back to productive use with a joint effort from coal companies and local bodies, but no concerted and coherent effort has 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 attempted. 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 its original state even for use for agriculture, plantation and housing. Some researchers claim that improvements in water retaining capacity of the subsoil in the subsided land are required. 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 is specific legislation guiding the coal industry in matters of subsidence and perhaps such enactment may be necessary in our country also.

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References:-

1. Agarwal. (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 Heinemann 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. Downing, T.E., Moles, Jerry, McIntosh I. (2002). "Indigenous Peoples and Mining: Strategies and Tactics for Encounters", International Institute for Environment and Development, London.

6. Ghose, K.M. (2004). "Effect of opencast mining on soil fertility" Centre of mining environment, I.S.M, Dhanbad, India.

7. Goswami S. (2013). Need for Clean Coal Mining in India. Environmental Research, Engineering and Management, 4:66: 79-84.

8. Goswami S. (2013). Coal Mining, Environment and Contemporary Indian Society. Global Journal of Human Social Science. 13: 6:17-26.

9. Goswami S. (2014). Coal Mining, Communities and the Environment. 1st ed. New Delhi Publishers, New Delhi, 103.

10. Goswami, S (2014), "Clean Coal Initiatives in India", European Researcher, Vol.81, No 8-2, pp.1502.

11. Madwbwe, C, Victor M and Sophia M. (2011). "Involuntary displacement and resettlement to make way for diamond mining: the case of *Chiadzwa* villagers in *Marange*, Zimbabwe", Journal of Research in Peace, Gender and Development, Vol. 1(10), pp. 292-301.

12. Mathur, H. M. (2008). "Mining Coal, Undermining People: Compensation Policies and Practices of Coal India" [In] Cernea M.M., Mathur H.M. (eds.), "Can compensation prevent impoverishment? Reforming resettlement through investments and benefit-sharing", Oxford University Press, New Delhi, pp. 260-285.

13. McDowell, C. /ed./ (1996). "Understanding the Impoverishment. The Consequences of Development-Induced Displacement", Berghahn Books, 1996.

14. Nish, S, Bice, S, "Community-based agreement making with land-connected peoples" [In] Vanlay, Frank, Esteves Ana Maria. /eds/ (2012). New Directions in Social Impact Assessment. Conceptual and Methodological Advances, Edward Elgar Publishing Limited.

15. Penz, P, Drydyk, J and Bose P. (2011). "Displacement by Development. Ethics, Rights and Responsibilities", Cambridge University Press, Cambridge.

16. Rao, D.N. (1971). "Air pollution and plant life": Department of Environment, London.

17. Singh, G, Laurence, David and Lahiri-Dutt K (eds.) (2006). "Managing the Social and Environmental Consequences of Coal Mining in India", The Indian School of Mines University, Dhanbad, India.

18. Saxena, N.C, Singh, G and Ghosh, R. (2000). "Environment Management in mining areas", Centre of mining environment, I.S.M., Dhanbad, India.

19. 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.

20. 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.

21. Wathern, P. (1988). "An introductory guide to EIA in: Environmental impacts assessments (2nd ed.), London, U.K, pp.3-28.