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## Risks and Rights: The Challenges and Consequences of Development in Indian Coal Mining Sector

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*Abstract*- 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 causes 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 on flora and fauna. To overcome from the problems one should have knowledge about the various activities of environmental concern. As we have seen earlier time that every mine managers keep 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. Therefore, the task is to make continuous efforts towards environmental improvement by each mine authority. The present paper discusses on various risks involved around coal mines activities in India. It also deals with the rights of the people to live in clean environment.

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# Risks and Rights: The Challenges and Consequences of Development in Indian Coal Mining Sector

Dr. Sribas Goswami

**Abstract-** 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 causes 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 on flora and fauna. To overcome from the problems one should have knowledge about the various activities of environmental concern. As we have seen earlier time that every mine managers keep 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. Therefore, the task is to make continuous efforts towards environmental improvement by each mine authority. The present paper discusses on various risks involved around coal mines activities in India. It also deals with the rights of the people to live in clean environment.

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## I. INTRODUCTION

Pt. Nehru, the first Prime Minister of India stressed the need of Environmental Impact Assessment of the projects and the management to avoid the imbalance of nature. The importance of the issue was reemphasized by Mrs. Indira Gandhi, another Prime Minister of India, at the United Nations Stockholm Conference on the Human Environment in 1972. Constitution of the National Committee on Environmental Planning and Coordination under the Department of Science and Technology in the same year was the first tangible step in this direction. The thermal power project at Delhi, fertilizer unit at Gujarat and hydro projects in Kerala were brought under the ambit of Environment Impact Assessment in the year 1978. The first comprehensive law "The Environment (Protection) Act 1986" brought out by the Government of India, empowered the Central Government to take all measures necessary to protect and improve the environment of the factories.

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Clean coal mining initiative has become essential in view of extensive damage to the environment and ecology with the surface mining and even with underground mining. The ash content of the inferior coal with the surface mining is increasing with the size of earth moving machinery when the bands are worked along with the coal. Mining of gassy coal seams and its combustion for power generation are the major sources of methane and carbon dioxide which causes pollution.

It was the Mines and Minerals (Regulation and Development) Amendment Act of January 1984 which had clear provisions for environmental protection related to mining activities. The Act specially addressed to damage of vegetation due to surface mining. The law provided "the manner in which rehabilitation of flora and other vegetation such as trees, shrubs and destroyed by reason of prospecting and mining operation shall be made in the same area or in any other area selected by the Central or State Government". The impact of deforestation was realized in the form of degradation of soil, flash flood and drought, destruction of wild life habitat, loss of flora, decrease in rain and rise in temperature of the region. So the risk of environmental damage was felt and expansion of coal industry was inevitable.

## II. SOURCES OF DATA & METHODOLOGY

The methodology of the study includes collection of research material over the field study and observation methods. The present study is based on both Primary and Secondary data. Primary data are collected from a structured interview schedule with the officers of Coal India Ltd. and secondary data are collected from CMPDI records, journals of IICM (Indian Institute of Coal Management) and books related to coal mines. The field study was conducted from the Coal India Headquarters and various collieries.

### a) *Environmental Management Planning In Coal Mining Sector for India*

The Environmental Management Planning to a great extent depends on socio-political and techno-economic considerations of any country. India with large population has its priorities in respect of employment, energy and environment. The coal mining being an

important component of this cycle has to grow with due care to environment and ecology. The planning hierarchy in developing countries showing various approaches is shown in following chart.

The domain of coal mining sector varies from underground to surface and the impact level marginal and slow in case of deep mining to devastating and total in case of surface mining. The underground mining provided a number of protective options to reduce the damage to the repairable level at the cost of coal to be left as natural support to the burden. The environmental management in case of surface mining was a synchronized exercise in view of large scale industry, which includes displacement of population, destruction of green cover, deforestation and environmental

damage. The dimension of damages though same in surface or subsurface is also dependent over the original environmental status of the region, quality of life and resource availability in the nation. The following aspects are taken into account in developed countries for the environmental management of the mining region.

- Coal Mining Details-Lease, Location and Space
- Base line Environmental Data for land, air, water
- Mining Option and Environmental Impact thereof
- Protective Measures for surface features, Air and Water
- Biodiversity and Societal Rehabilitation Schemes
- Environmental Management Rules, Acts and Norms

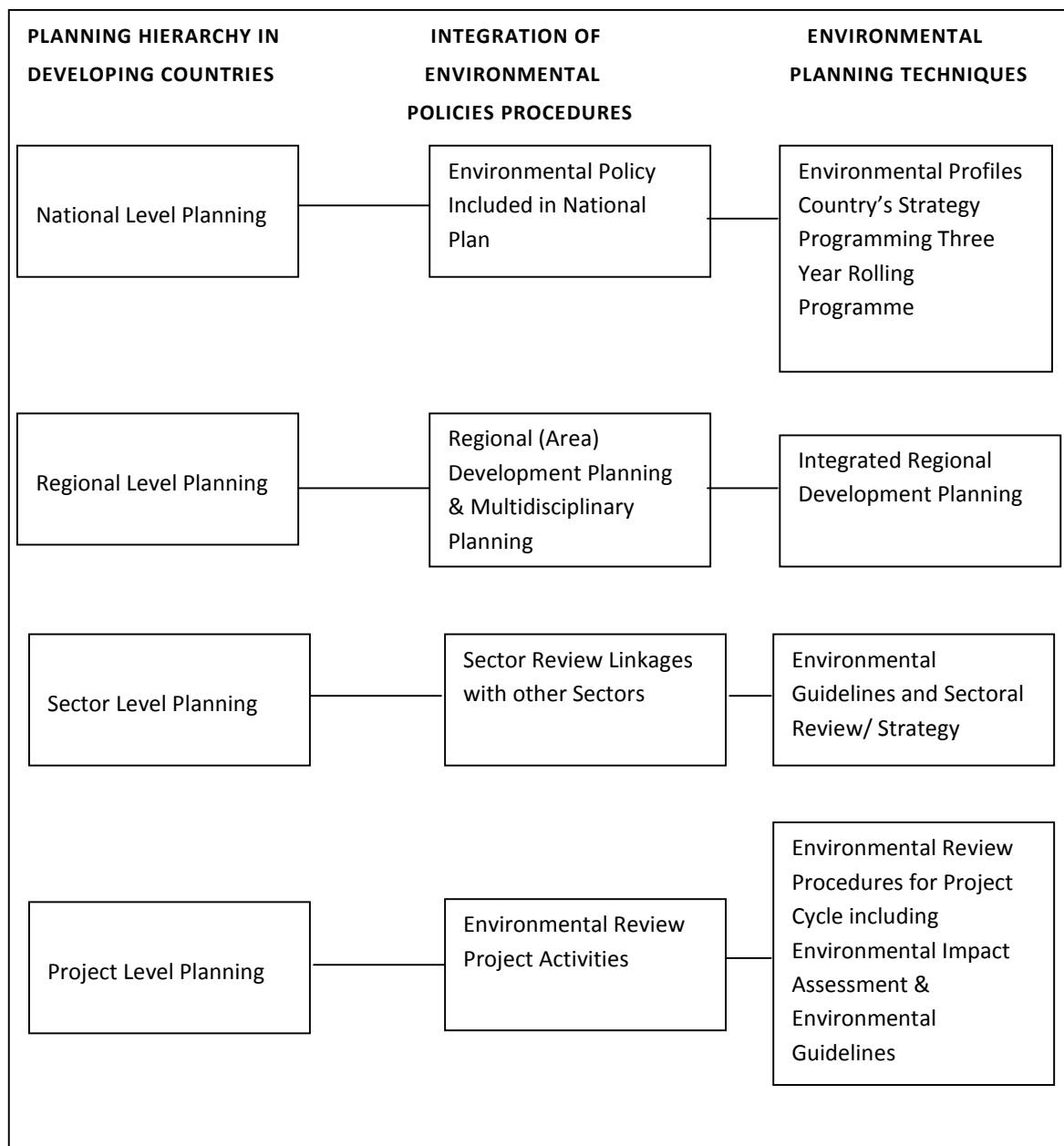


Figure 1 : Planning hierarchy in Coal Mining Sector in India

The objectives of the environmental management plans for the coal mining sector have accordingly been defined to match the expectation of the common mass. The economics of environmental management has to be balanced to the marketability of the proudest under the developing economy and its impact over the poorest of the poor people. In case of mining, the following environmental missions are identified.

1. Integration of environmental control measures with coal mining so that the operation is environmentally compatible and socially acceptable.
2. Adopt measures to keep the ecology of the mining field friendly to flora and fauna, maintaining economic viability of the mining sector.
3. Rehabilitation of the affected population in respect of their employment, shelter and social amenities.

Integration of environmental parameters in mining operations is statutory obligations under the Environment Protection acts made environmental safeguard mandatory for the mining industry. The Government further stipulates that the Environment Management Plan should be presented to an expert committee for appraisal and clearance.

The Ministry of Environment and Forest vide its amended notification of May 1996 for Environmental impact assessment of development projects stipulates that environmental clearance is essential for expansion, modernization of start of new projects. In the list of new projects requiring environmental clearance, mining projects with leases more than 5 hectares are also included in Schedule I. The projects includes in the schedule where pollution is likely to increase in existing load in respect of emission, liquid effluents and solid or solid or semi solid wastes.

#### *b) Environment, Coal Mining and Society*

Physical parameters of the environment and ecology of the mining belts are disturbed with the mine working and the impacts are manifested in the form of health and safety hazards of the miners. The impact in case of surface mining is devastating covering the land, water and air of the region much beyond the mine boundary while the underground mining affected mainly the underground workers and the population over the lease is least affected till surface subsidence or fire occurred due to unscientific mining. A number of committees are constituted after independence to streamline the underground mining activities in the interest of conservation and safety of the workers and the workings, land and environmental disturbance of the region. The safety of the miners against the environmental hazards has taken care of under the rules and its impact over the residents in case of surface subsidence is compensated for land, house / building and other social amenities. The forest cover within and around the mining area though not directly damaged till

the stage of depillaring or long wall caving slowly thin down with cutting of the valuable trees for the new settlers, timber for mine support and as a fuel by the poor tribal population.

The subsided land can be restored with mining of expenditure towards leveling, filling of cracks and extending irrigation facilities for some time but the miner have no interest to restore the land and the common men have no right to do so due to some legal difficulties. The coal mining involves use of heavy earth moving machines; large scale waste rock stripping, handling and transport. It has direct impact over the mine workers, invariably covered under the welfare scheme of the industry. The land owners (land looser) of the mining region are compensated due to mining induced displacement for land price and employment as per norms. The price of the land are paid to them is hardly enough to establish themselves elsewhere as the land holders and the whole families are converted to social parasite. The tribal settlers thriving on forest produce, cattle rearing or as laborer in the farms has become destitute as they have practically no holding of their own to be compensated in legal terms. They are just displaced from their habitat with "very liberal compensation towards housing space." The dust, smoke and noise produced by heavy earth moving machinery, heavy drilling and blasting of the burden crossing the core mining sector and buffer zone of the other hand disturbs the nature's bounty. They are even depriving of pure drinking water and clean air essential for their survival.

The land is transformed to barren dumps and has lost its fertility and capacity of self sustenance. The barren dumps have become eye shore amidst the scenic spots of the forest for decades. The leaches from the dump have made the water polluted in terms of acidity, hardness and particulate matter. Diversion of the surface water sources disturbs the drainage pattern and its availability. The disturbance of the aquifers and lowering of the water table causes slow death of the plants, erosion of the soil and loss of the biomass. The mining activities disturb the ecology and environment with the development of every block, leaving a trail of destruction over the dwellers, biodiversity, fields and forest cover behind. The reclamation process in case of underground mining is very simple and techno-economically viable while, in case of surface mining, the damages bring far reaching and devastating consequences unless concerted efforts are taken towards Environmental Management.

The policy of environmental management is based on global commitment and national priorities defined under different acts and notifications. The mine working has to be planned in a way to keep the environment and ecology of the region least disturbed and the land fertility and water regime has reclaimed as normal as it was before the start of the mining.

Environmental clearance has to be obtained from the competent authority in case the mining lease is more than the permitted limit. This is also essential for the modernization or extension of the old projects or start old projects or start of new projects because the local community is very much affected by regular mining activities. Here every Coal India should introduce the Corporate Social Responsibility scheme to ameliorate the local community.

### III. COAL MINING ACTS IN INDIA

#### a) *Underground Mining Acts*

Environment of underground coal mines have been known to be hazardous with the frequent occurrence of roof fall, gas and coal dust explosion, spontaneous heating and fire in coal seams water inundation, poor lighting and a number of occupational disease. The first mines Safety Rule came into force on March 22, 1901 and with a number of modifications, the Coal Mines Regulation came into existence in 1957. This was found to be necessary in the background of high casualty in the coal mines. The gas and coal dust explosions posed serious threat to the miners in addition to serious health hazards due to mining environment; the domain was covered in totality through different notifications and revisions in acts and rules over the years with material difference in underground coal mining environment.

#### b) *Regulations, Acts and notifications*

The Coal Mines Regulation 1957, amended till date has given emphasis over the following parameters relevant to the safety of the mine and mine environment.  
*Reg. 116* Classification of seams according to gassiness;

Coal seams classified into different degrees as per gassiness

Precautionary measures against inflammable gases

*Reg. 118* Underground precautions against fire

*Reg. 119* Precaution against spontaneous heating

*Reg. 121* Precaution against Carbon monoxide

*Reg. 123* Precaution against coal dust

Accumulation of dust and explosion

Precaution of air borne dust

*Reg. 124* Precaution against irruption of gas

*Reg. 126* Danger from surface water

*Reg. 127* Danger from underground inundation

*Reg. 136 (A)* Velocity of air current

The problems of gas explosion, spontaneous heating, heat and humidity were controlled underground by improved ventilation circuit and air velocity. The recommended air velocity for different places of activity is summarized in the following table.

Precautionary measures for safe environment have been suggested in the Regulation or Acts and through different notifications and circulars. In majority of cases, the liability of a major disaster in a mine is its

inherent proneness and hence each mine is suggested to be examined critically for its environment, ecology, hazards and disasters. The source of hazards like electrical appliances and other equipment's are regulated by stringent statutory act for their safety and usage the clean coal winning and transport technology is suggested to keep the particulate pollutants within the permitted limit.

#### c) *Surface Mining Acts and Norms*

The surface mining and its impact over environment and ecology are quite different from those of the underground mining because of its locale, geometrical dimension and level of activities. Irrespective of the method and level of mechanization, the damage to environment and ecology with the surface mining is devastating. The land availability for the surface mining has been a herculean task for most of the projects mainly because of the non availability of land for compensatory forestation, no progress in the creation of the land band by the State Governments, abnormal demand for employment and payment towards compensation and rehabilitation benefits by the land owners. The poor reclamation of the waste rock dumps, and no guarantee for restoration of land to the owners even on long term do not ensure their sustenance. The reclamation of land to its premising status is of utmost importance while planning a surface mine but the efforts are too little in this direction. The other casualties with the surface mining are the green cover, forest and biodiversity. With the use of the waste rock and coal, the atmospheric pollution is the second hazard associated with the surface mining. The disturbance of hydraulic regime including loss of ground water, damage of aquifer and pollution of water sources are the other dimensions of the surface mining.

#### d) *National Policies and Programme in India*

The Coal Mining Regulation 1957 amended up to 1975 has practically no statutes controlling the impact of surface mining as the mines are a few and small and damage to the environment is insignificant because after the Supreme Court intervention against the disturbance of the fragile ecology of Doon Valley. The 42 Amendment of our constitution provides legal foundation for environmental protection. Under the amendment, the responsibility of the protection and improvement of the forest lands, rivers and wild life is vested to general public along with the Government. Some of the acts covering air, water, forest land and hazardous wastes enforced by the government are as follows:

1. Indian Forest Act 1927
2. Wild Life (Prevention) Act, 1972.
3. Water (Prevention and Control of Pollution) Cess Act 1974.
4. Water (Prevention and Control of Pollution) Cess Act 1977.



5. Forest(Conservation) Act, 1986
6. Air (Prevention and Control and Pollution) Act, 1981.
7. Environment (Prevention) Act,1986
8. Hazardous Wastes (Management and Handling) Rules, 1889
9. Wild Life (Protection) Act-Amendment, 1991
10. Public Liability (Insurance) Act, 1991

The provisions of the acts include the aspects of damage to the environment due to all the industrial activities like river valley projects, thermal power projects and mining projects. In addition, a number of provisions are made under the Mines and Minerals (Regulation and Development) Act 1957, Mineral Concession Rule 1960 and Mineral Conservation Development Rules 1958. These rules and acts are amended time to time to take care of different dimensions of environment, especially relevant to mining. Clause 5; 31 to 41 of Mineral Conservation and Development Rules 1988 covered the base line data on environment and scheme of prospecting.

A notification under Environment Panning Act and Rules has imposed restriction over mining in wild life sanctuaries, national parks and adjoining to national monument, areas of the cultural heritage and fragile ecology. The environmental clearance from the Ministry of Environment and Forest was just an administrative formality till January 1994, but it was made essential on the light of environment impact assessment of development projects amended in May, 1994. Now new mining project has to seek the following permits from different authorities before it is approved for implementation.

1. Consent form the State Pollution Control Board for water and air pollution separately under the concerned Act.
2. Site clearance and Environment clearance under EP Act
3. Forest clearance under Forest Act and Rules if it was within the forest area.
4. Clearance for mining in the restricted area notified under EP Acts

The surface coal mining project authorities are required to submit different reports and returns under declared policies of the Government of India related to mining, forest and environment. It is mandatory to declare reclamation and protective measures as stipulated under notional policy and acts, resource allocation including managerial structure for compliance and check list for environmental auditing.

#### e) *Environmental Legislations related to Mining in India*

During sixties the environmental problems did not receive adequate attentions from the people of India even in developing countries. In most industrialized countries, environmental problems posed a threat to quality of land, water and air, but the responses of the Government were in general and weak. The laws of

general nature regulating pollution and degradation of water and air were enforced in many countries since long, but these weak and general laws were insufficient to control the damage caused by industries like mining which was distinct and unique in creation of the environmental problems.

Situation in global environment front took a dramatic turn after United National Conference of Environment was organized in Stockholm, Sweden in 1972. Subsequent to the conference many countries established government departments to look after the job of protection of environment. Subsequently Brundtland report on World Commission on Environment and development presented in 1987 and second World Environment Conference in Brazil (Rio de Janeiro) in 1989 intensified the interest in environmental matters. From seventies till today environmental legislation in industrialized countries has developed significantly.

In the field of environmental legislation in India has tried to follow the footsteps of developed countries. In consonance with the world trend, environmental problems are now receiving lot of attention in India also. But it would not be correct to say that in earlier days, the Government was totally devoid of environmental concern. Even before the passage of specific environmental protection act during the last two decades, there were many Central and State Enactments which were having direct and indirect bearing on protection of environment. These include Forest Act, the Factories Act, and the Motor Vehicles Act, the Insecticides act, the Criminal Procedure Code, the Indian Penal Code and the police Act.

The country's first Legislation having direct environmental bearing shore Nuisance Act was passed in 1953. The Bengal Smoke Nuisance Act was promulgated in 1905 followed by similar acts passed in Bombay in 1912, a number of acts on paste control, land utilization and land erosion and reclamation of waste land were passed even before India gained its independence in 1947.

After Indian Independence, a number of acts which have some direct or indirect hearing on environmental degradation and protection have been passed by central and state legislatures. Notably among the state enactments are Orissa River Pollution and Prevention Act, 1953 and Maharashtra Water Pollution Act, 1968. Among the central enactments, Radiation Protection Act of 1972 may be mentioned. But all these enactments are rarely enforced because of lack of appreciation and initiative which have been definitely contributed by people's apathy towards the environmental issues.

After the first global conference on Environment organized by United Nations in 1972 which was attended among others by late Prime Minister Indira Gandhi, the Indian policy planners became conscious of

the environmental issues and this became evident when Indian Constitution was amended to incorporate environmental protection in Directive Principles of constitution. The article 48 (a) of the Directive Principle of the Constitution states that it is the duty of State to protect and preserve the natural environment in general and the forests and wild life in particular. Article 51 (a) in the fundamental duties enjoin the individual to preserve and promote the natural environment including the forests, wild life, lakes, rivers etc. Incorporation of the provisions of environmental protection in the constitution have indirectly encourage public spirited citizens to take help of these provisions as well as some of the earlier acts mentioned above to move the court on behalf of the society to get appropriate relief.

The Indian Courts have taken these public interest litigations regarding environment very seriously and have tried to protect the right of the society to have pollution free environment. But the absence of specific standards and Guidelines has been an impediment for the court as well as the Government and therefore the Legislature has passed a number of specific legislations regarding the environmental protection.

*f) Water Prevention and Pollution Control Act*

The specific environmental laws started coming into operation, much later in India. The 'Water Prevention and Pollution Control Act' came into operation in 1974, and subsequently; was amended in 1988. As per these acts, pollution boards in the states and the Central Pollution Control Board was constituted to take care of the pollution of water. The act has given the state pollution control boards power of entry and inspection in an industrial establishment. Also the boards are empowered to lay down standards of effluents which may be permitted to discharge effluent to water sources.

It is made necessary that persons establishing an Industry, operation or process must have to get prior consent of the board if the operation, industry or process discharges sewerage or effluents into a stream or well. The board is empowered to impose penalty in case of contravention of the different provisions of the acts. The 'Water Prevention and Control of Pollution Rules, 1975' was framed to give specific guidelines regarding the constitution of the Boards and its different offices and related matters.

*g) Air Prevention and Pollution Control Act*

The 'Air Prevention and Pollution Control Act' was passed in 1981. By this act, persons who are willing to establish any industry in air pollution control area, has been enjoined not to discharge emission of pollutants in excess of the standard laid down by the State Board. Prior permission has been made necessary for starting any industry or operation. Central and State Pollution Control Boards are entrusted to inspect and collection of samples as in case of water act is vested with.

*h) Environment Protection Act*

A comprehensive act entitled "Environment Protection Act" was promulgated in 1986. The act widened the scope of environmental protection activities of the Central and State Boards. All sorts of environmental pollution in excess of standards laid down were prohibited at that time. With the establishment of environmental laboratories a detailed guidelines regarding pollutants and different industries have been framed. Environmental audit has also made mandatory as per number of other acts and rules which is related directly on environmental protection.

Under the provisions of the Act, expansion or modernization of any existing industry or new projects cannot be undertaken in any part of India unless they have been accorded environmental clearance by the Central Government or by the State Government concerned, as the case may be, in accordance with specified procedure any project located within 10 km of the boundary of a reserved forest or a designated ecologically sensitive area or within 20 km of a national park or a sanctuary requires environmental clearance from the central Government.

*i) Mines and Minerals Regulation and Development (MMRD) Act*

The principal act was made in 1957 and was amended in 1972 and was further amended in January 1987. The Government by this act has assumed power to prevent a licensee or lease holder from damaging environment. The mining plan is required to be submitted along with environmental management plan. In the event of grant of mining lease, the leaseholders are under obligation to conduct mining operations in accordance with approved mining plan. The Government has assumed power to direct the industry regarding the rehabilitation of a particular flora and other vegetation, trees and shrubs destroyed during the process of prospecting and mining.

*j) Mineral Conservation and Development Rules, 1988*

The Mineral Conservation and Development Rules 1988 are administered by the Indian Bureau of Mines, a department of the Central Government under the Ministry of mines. As per the rules every mining operations in any area has to be in accordance with the mining plan and there is provision of review of approved mining plan at interval of 5 year from the date of commencement if mining operations. Every mine operator is required to take all possible precautions for protection of environment and control of pollution while conducting prospecting, mining, beneficiation of metallurgical operation in the area. It is ensured that the air, water and noise pollution levels are within the permissible limits. The rule says that limits of all pollutants including noise would be notified by the concerned authorities under the provisions of relevant statute from time to time.

k) *Forest Conservation Act, 1980*

The Forest conservation Act, 1980 is administered by the Union Ministry of Environment & Forests. The legislation is enacted to check deforestation. The act stipulates that no use of forest land for any non-forest purpose including mining will be permitted without the prior approval of the central Government. Consequently a forestation is one of the important conditions while approving proposals for diversion of forest land for non-forest purpose. Compensatory a forestation is to be done over equivalent area of non-forest land must be utilized for a project. With the passage of various Environmental Legislation the environment protection in mining area may definitely get a boost. The Mining conservation and Development Rules specifically keep coal mining out of its purview, but there is no doubt that basic laws on water and air pollution and comprehensive environmental protection acts are general in nature, and may be useful in minimizing environmental damages in coal mining areas.

Mining industry creates some special environmental problems which are unique in nature. The damage to land by open casting and subsidence, blasting vibration and lowering of ground water table due to continuous pumping out of mine water are some of the environmental problems which are not created by any other industry.

l) *Specific Environmental Legislation on Surface Mining in India*

Surface mining of open casting today represents one of the worst forms of environmental degradation among all forms and varieties of industrial activities. With ever increasing power of varieties surface mining machineries the scars left are wider and deeper. Because of the immediate cost factor involved coal industry of every country shows preference for this form of mining. India currently gets around 70 percent of its production from surface mining only. Even coalfields of West Bengal which is barely practicing surface mining before nationalization presently gets over 60 percent of its production from open casting<sup>1</sup>. Against the above background the following aspects concerning surface mining deserve some thoughts. Before 1977, coal companies were operating in an unregulated free market. The result was serious environmental degradation accompanied by a lowered quality of life for those citizens living on the country's coal mining regions. The ability of coal mining regions to attract new businesses and industry was severely curtailed. Finally, in the sixties, citizens of the nation's coal regions organized an attempt to force the federal legislature to develop and implement a regulatory programme for

minimizing such harm. India produces nearly 70 percent of its total annual production of nearly 240m.t of coal by surface mining only. As per the existing statute and related executive provisions' Environmental Management Plan (EMP) is needed before a mining lease is granted. Environmental Impact Assessment (EIA) Report is also necessary in most of the cases. Reclamation is mandatory and the method should be spelt out in EMP. But even with all these, the situation is not such that Government may effectively control surface mining activities and ensures environmental protection with existing statutory situations.

m) *Agitation of local community against Open Cast Coal Mining in Eastern Coalfields Ltd.*

The agitation against starting the Sonepur Bazari opencast project in ECL financed by the World Bank delayed the starting of the project by few years. This has surprised many Indian mining engineers who are in general not conversant with the world mining situation. The environmental problems created by open casting have been the cause of many public agitations in India at a large scale and the authorities have to introduce a system where local citizens have a dominant say in this matter.

The importance of public opinion is increasing day by day. The mining legislation insists that open casting proposal go to a public enquiry and Environmental Impact Analysis (EIA) report would have to be put up before the enquiry. The policy planners in India should take timely action to safeguard local community's environmental interest by formulating suitable legislative procedure pertaining to surface mining before the coalfield communities themselves take an imitational course.

Displacement or up-root of settled people is a common as well as hanging problem in any coal mining area and obviously treated as an age-old problem of coal mining area. Raniganj also faces all the related issues due to coal mining activities involving environmental as well as socio-economic degradation. Resettlement is a term used to describe the movement of individuals or groups from one location to other, although the term can refer to voluntary or involuntary human migration, it is often a euphemism for forced migration due to any such activities. The increasing demand for Coal requires an expansion and speeding up of coal exploration, production and processing in the country. A great ongoing 'social challenge' for the coal industry is the problem of Mining-Induced Displacement and Resettlement in the present study area. Eastern Coalfield Limited (ECL) is taking special care to provide generous package of compensation to project affected persons. But the difficulty lies in the fact that not only do the people lose their houses, but they are also deprived of the land and natural resources that constituted their economic survival base. The natural resources are non-

<sup>1</sup> See M. Areeparampil, "Displacement Due to Mining in Jharkhand", Economic and Political Weekly, vol. 31, no. 24, pp. 1524-1528.



formal sources of income which are rarely recognized or documented, and hence rarely compensated for. So, lots of environmental and social problems are generated due to such activities knowingly or un-knowingly. Other concerns due to mining-induced displacement and resettlement are some of the demographic, socioeconomic and cultural problems including the changes in population dynamics, health impacts, addictions, economic disparity and frustration. All these are affecting not only economic, but social, moral and cultural degradation, which are reframing the existing lifestyle in holistic manner. Therefore, displacement of villages along with their long standing economic, social, religious, and cultural activities is inevitable. When coal occurs in land held traditionally by indigenous people, mining gives rise to question of social justice. Displacement has an undermining influence on social bonds and cultural roots of the entire community, thus leads to Social problems.

*n) Lack of Specific and Definitive Legal Provisions to Protect Environment*

There is no specific standard to minimize environmental damage, to protect public health and safety and preserve agricultural, to protect public health and safety and preserve agricultural productivity. It is true that an EMP is to be submitted before mining permission is granted but due to absence of specific standards pertaining to reclamation and other aspects, EMP may become subjective and very frequently a project may be approved on the basis of a sketch by EMP. Under such situation the effective intervention by Judiciary, if needed, may be taken care of. It would have been much more convenient for the judges, for setting out necessary standards of pollution.

*o) Enforceability – The Supreme Court of India*

Environmental legislation in India has not been effective at the early stage due to lack of enforcement by regulatory bodies but the Indian judiciary have all along taken abiding interest in environmental matters. The recent decisions of Supreme Court in a number of cases closing a number of factories have shaken the regulatory authorities out of their indifferent attitude. But in matter of surface mining the greatest difficulty is that environmental damage would not vanish even if Government closes surface mining operation under section 5 of Environmental protection Act of 1986. This is especially true about land reclamation and therefore some sort of performance bond must be made mandatory before allowing surface mining in an area. For instance in USA prior to enactment of SMCRA many coal companies abandoned mining operations without reclaiming the mined land. Ultimately USA congress had to introduce a scheme by which the coal companies would have to provide bonds which would allow the regulatory authority to reclaim the land if the company which carried out the mining operations is financially

unable or refuses to complete reclamation. In India such a scheme of 'performance bond' is very much necessary especially when private operators are being allowed entry in coal and other mining sectors.

*p) Citizens Participation to Protect Environment*

In the whole process of Environmental approval of a project in India, the Citizens, who are the central figure in the whole issue of environmental management have got very little role to play. The perusal of evolution of environmental legislation related to mining of countries like U.K. and USA would indicate that ultimately the legislation have to offer a prime place to the citizens likely to be affected in the whole scheme of environmental protection. If there are objections by the interested parties, then a public enquiry is to be held. For example there have been a large number of cases in Coalfield Communities Campaign (CCC) of UK has been able to move the Government of impose severe restriction on opencast operations and sometimes to scrape the opencast projects. The SMCRA of USA also incorporates citizen's participation in the whole process of decision making<sup>2</sup>. The public enquiry before a project is sanctioned is a part of the French scheme also. It is high time that the country like India formulates specific, definitive and stringent laws to deal with the environmental problem created by mining and such legislation should offer a major role to the coalfield communities which are likely to be affected by the project.

*q) Plantation on Mine Spoils in Indian Coalfield*

Mining industry traditionally has a very poor image regarding degradation of the environment. Surface mining is particularly vulnerable to this charge as very nature of this activity requires complete removal of the vegetation and excavation of the strata which makes great alteration in the topography of the area. Mining also causes land damage mainly by subsidence. Underground and surface mining are both result in the formation of spoil heaps and construction of tailings dams.

In the general view restoration means returning the land to what it was before mining i.e. forest back to forest or agriculture back to agriculture and recreating the original topography. The dictionary definition of reclamation is "the recovery of wasteland, desert, etc by ditching filling or irrigating". But the generally accepted definition of reclamation in the mining context is "any treatment which is not restoration but brings land back into some beneficial use such as forestry, recreational area, agriculture, etc. after it has been degraded by

<sup>2</sup> J. Nehru called large dams 'temples of modern India' in the sense that he was affirming a commitment to modernization and socialism in post-Independence India. On the broad context of development-induced displacement in India see: S. Somayaji, S. Talwar (eds.), Development-induced Displacement, Rehabilitation and Resettlement in India: Current issues and challenges, Routledge, New York, 2011.

some operation such as mining and waste dumping". Some people consider the objective of reclamation as to help the natural process by which a disturbed parcel of land stabilizes both physically and biologically. The defecation of mined land reclamation then becomes "the process if artificially initiating and accelerating the natural continuous trend toward recovery or stabilization of a disturbed area"

*r) Reclamation of Large External Overburden Dumps Created on Plain Ground*

A majority of the opencast coal projects being planned these days have external O.B. dumps accommodating 30 to 50 percent of the total O.B. material to be excavated. Such dumps are planned in lifts of 15 to 30m to reach 60 or 90m height and individual dumps may occupy an area of 10 to 100 ha<sup>3</sup>. The higher the dump height, the less will be the land area needed for creation of the dumps. But dump height is limited by the bearing capacity of the soil and rock layer at its base, and form consideration of increased cost of transport of O.B. material, greater problems of erosion, and risk of slope failure with increasing height of dump. A large and high external O.B dump should be reclaimed as early as possible, even in parts, as active dumping goes on at some other part of the dump.

Ideally the dumps should be re-handled and the void created by mining be filled with this material to generate a landform having the "Approximate Original Contour" of the area. This American concept is hardly applicable in India as it would greatly push up the cost of our coal (and other minerals or make many of the deposits unworkable). The next preferred method would be to re grade the dumps to have gentle slopes matching the landform of the region which would make the dumps visually less intrusive. This would cost less than taking back O.B. material to the excavation but still the cost will be very high. As a compromise, the overall slope in planned to have a gradient of 1 in 2 or approximately 270 but within the sides, the material is dumped to roll down at its natural angle of repose which is generally of the order of 380 for coal mine overburden but then slightly graded to give a slope of say 350 within the benches. The haul road provides a break for the flowing water and any O.B. material coming down the dump slopes. The ramp should have drain at its inner edge and a slight slope toward the core of dump along the transverse section to permit easy collection of seepage water.

This water should be guided down along proper drains of the dump slope and not allowed to cascade

down uncontrolled which then forms erosion gullies. If the area is rich in top soil, the whole of the O.B. dump may be covered with top soil, of say, 30cm thickness. Generally so much top soil is not available and in such case, pits of about 0.2 m<sup>3</sup> in size should be dug at points on 2m X 2m grid and filled with top soil<sup>4</sup>.

All strata do not have the same weathering characteristic. If during placement of overburden on the dump, care is taken to place easily weather able rocks on the top part, the reclamation effort would be assisted. The successful examples of external O.B. dump renegotiation come from places with a fair degree of soil layer in mining or weather able rock as in Jharia, West Bokaro, and Kenda etc. Water management on O.B. dumps is crucial to prevent erosion to place well as for success in re vegetation effort. The dump top has to be compacted and there should be some clayey impervious material as otherwise water would not be retained on these reservoirs. The vegetation should be selected considering the climate of the area and the need of nature of the O.B. dumps Depending on the amount of top soil available in the area and the need of community, the external O.B. dump can be converted into a dense forest, wild life habitat, pasture land or recreational area. The very nature of opencast mining requires the mineral to be excavation and removal of overburden material. Thus an initial external dump is created in all cases. In case of large opencast mines, after the mineral deposit is mined over a sufficient area, space may become available for in-pit dumping to be done only when the bottom most seams is worked out. Thus, the volume of overburden material which has to be dumped outside depends upon the type of the deposit being mined. The land area required for accommodating the external overburden dump depends on the volume of O.B material and the height of the dump.

*In-Pit Overburden Dumps and environment in Coal Mining Area*

An effort would be made in all mining projects to start in-pit dumping as early as possible. The beneficial effect is two-fold. The size of the external O.B. dump reduces and the excavation itself gets filled up and provides an opportunity to restore the land to its original topography and land use.

The overburden strata increased in volume 10 to 15 percent on breakage. However, with passage of time the O.B. dumps settles and subsides. If during initial placement of O.B. material in the pit, a level near about that of the ground level is maintained, with settlement of the dump, a depression will be formed. This will cause formation of water pools and give rise to problems of seepage and instability of dumps. At the same time the formation of water pools and gives rise to problems of seepage and instability of dumps. At the

<sup>3</sup> Source: Fernandes, Walter (2006). "Mines, Mining and Displacement in India" [in] Singh, Gurdeep, Laurence, David and Kauntala Lahiri-Dutt (eds.). (2006). *Managing the Social and Environmental Consequences of Coal Mining in India*, The Indian School of Mines University, Dhanbad, pp. 333-344.

<sup>4</sup> See CMPDI Report -2012

same time the original drainage pattern of the land gets disturbed. Hence it is better to make the internal dump height some 1 to 2m higher than the ground level higher than the ground level which after settlement may still keep it a few cm higher than GL(Ground level). In shovel-dumper method of mining it is easy to keep the order of broken strata in the dump same as in the original ground by suitably directing the loaded dumpers. In dragline mining, however the order of strata gets reversed. This may lead to some problem if a toxic layer is present in the overburden at depth which will come near the surface.

If the mining area has a thick alluvial cover with rich top soil, it would be possible to make the in pit dump into agricultural land by spreading of the top soil. For a few years, the land may have lower productivity and may need help in the way of fertilizer application. However, cultivation of leguminous plants may enrich the soil over the dumps so that the land regains its productivity.

In most mining areas however a thick layer of top soil is not available. A forestation has been the most popular method of reclamation in such cases. Because of the poor nutritional status and water retention capacity of fresh dumps, only hardy species have the chance of survival. A quick growth of vegetation would reduce erosion from the dump and improve the nutritional status of the soil. A mixed forest of locally useful species should be preferred although some of the exotic varieties like Eucalyptus or Acacia auriculiformis can withstand very severe drought conditions. Some of the indigenous drought resistant plants are Shisham (*Dalbergia sission*), Neem (*Azadirachta indica*), Babul (*Acacia nilotica*), Choukundi (*Cassia siamea*), and Amaltas (*C.fistula*), Ber (*Zizyphus Jujuba*), Karanj (*Derris indica*), Black siris (*Albizzia lebbek*), White siris (*A.procera*) and Bakain (*Melia azedarach*). Different

kinds of bamboo (*Dendroclamassp.*) have great economic potential and in the same time these have strong soil binding capacity. On dump slopes Sisal (*Agave sisalana* and *A.mexicana*) plants are very effective in binding the soil. In some areas of RCF and JCF goat's foot creeper has been used very effectively in reducing erosion of dump slopes and at foot of the dumps.

In majority of large coal mining projects, 50 to 70 percent of the overburden only is placed in the excavated ground at the last stage of quarry, a large void remains unfilled. In India where the mined land has to be brought back to the approximate original contour (AOC) this soil is filled by re-handling of spoil from earlier dump at considerable cost. Some typical US methods are to employ (a) tractor dozers to push the material (b) a dragline on the spoil side of the pit and (c) a dragline on the high wall side with additional hoist and drag rope and track type pipe-layer to back- fill the material. In India, the AOC concept is not followed and the last part of the quarry gradually gets filled with water up to the restored water table. Water reservoirs formed this way in many of the earlier shallow opencast mines are used by local villagers. Water does not accumulate where the dip side deposit is worked by underground methods and it is connected to the quarry through connecting galleries or a permeable barrier. For water reservoirs to be useful for the community, the banks must be gently sloped and grassed. Large water bodies permit many uses depending upon the need of the community – for storage of irrigation water, as water sports and recreation ground. In Parasea colliery (RCF), tank has been created from opencast mining, the bank sloped, afforested and the villagers are so happy that the company gets their cooperation in getting fresh land for quarrying.

Table No. 1 : Plant Species Planted in the Jharia and Raniganj Coalfield

S.N.	Botanical name	Average height of plant (cm)	
		After 8 months (Aug. 01-Mar, 02)	After 13 month March, 02-Aug, 02)
1.	<i>Acacia auriculiformis</i>	53.8	106
2.	<i>Azadirachta indica</i>	48	138
3.	<i>Alstonia scholaris</i>	35	98
4.	<i>Derris indica</i>	65	95
5.	<i>Dulbergia sissou</i>	52	134
6.	<i>Eucalyptus sp.</i>	110	180
7.	<i>Leucaena leucocephala</i>	120	148
8.	<i>Melia azadarech</i>	60	121
9.	<i>Gamlena arborea</i>	53	100
10.	<i>Termelia arjuna</i>	53	75

Sources: CMPDI Survey Report, 2012.

The survival rate of the species was 85%. The volume of each pit was 0.24 m<sup>3</sup> and filled up with

overburden material mixed with some quantities of weathered spoil from the top layers.

s) *Control of Growth of Fire Stick Weeds as a Preventive Measure against Spread of Mine fire*

Mainly two weeds Eupatorium Odoratum and Ocimum Gratissimum are found in Indian coalfields act as fire stick during summer. During the survey, it has been found that, on acidic spoil (pH- 4.5-5.5)<sup>5</sup>, they spread very fast, but once the pH value rises to 6.6.5, these plants are replaced by other plant community like –Xanthium, Lantana, Cassia, Scoparia, Croton, Tephrosia etc. Hence by pH correction of the spoil, the spread of these fire stick weeds could be controlled.

t) *Sustainable Development of Coalfield of Raniganj and Jharia*

Coal and minerals are wasting asset and every mine has a limited life span. The lifespan may be sufficiently big for an individual but for an area or a province it is not. A number of mines of Eastern Coalfields Ltd. and BCCL have been closed down in recent years. The closure of some more collieries are imminent. Over the last twenty years the number of people employed in collieries of Raniganj and Jharia has dwindled whereas the production remained stagnant. A number of factories in the coal belt and its fringe have closed or are sick. The agricultural labors are becoming surplus because of land loss and land degradation but they have no alternative occupation to adopt either in mining or in other engineering industry.

The above facts underscore the necessity of developing a conscious and rationale strategy for sustainable development of coalfield areas of Raniganj and Jharia. Before trying to outline such strategy it would be worthwhile to trace the history of past development and to examine how and why it has deviated from a desirable model of sustainable development.

#### IV. WAY TOWARDS SUSTAINABLE DEVELOPMENT OF COAL MINING

The non-sustainable nature of development in the coalfield areas of Raniganj and Jharia need to be reversed. Both the government authorities and local people should come for word to make a sustainable development of this region.

a) *Giving Agriculture and Related Activities a Boost*

The first step towards sustainable development in the coalfield would be to develop agriculture and related activities side by side with mining and other industrial activities. More than 50 percent of the coalfield is essentially rural though rural and mining activities are

interwoven in a common fabric. The presence of mining and other activities would provide market for agricultural, poultry and dairy products just at next door. This would provide greatest help in sustaining agricultural activities.

b) *Use of partially Degraded Undermined Land*

There is vast stretch of undermined land under the ownership of Eastern coalfield Ltd. and BCCL. Much of this land is partially degraded but with very little additional effort may sustain agricultural activities. The land now remains unutilized as the coal company feels that they may need the land again for mining and it may be difficult for the company to undermine the land once agricultural activities are started on the land though legally the ownership of the land may be retained by them. Similarly there are a large number of unutilized ponds and tanks also under the company ownership.

An arrangement may be made whereby the land, ponds and tanks which would not be needed in the coming five years may be given in lease to 'Zilla Parishad' or to a specially created organization of the State Government. This may be possible through an agreement between the coal company and the concerned 'Zilla Parishad' with the State and Central Government providing the guarantee for the faithful execution of the terms of the agreement.

c) *A forestation Programme*

As per the recent practice, every mining project is to be cleared by the Department of Environment before its implementation. The project report submitted by the industry gives a blueprint of the proposed environmental protection measures to be taken-up by the company. A forestation is a common part of environmental protection, almost in every project.

The environmental protection measures including a forestation may create a large number of jobs within a project and for such type of jobs, people with agricultural background is more suitable. It is, therefore, suggested that after the blueprint of a forestation has been drawn-up, the work may be given to the adjoining village Panchayats (Local Self Government) on a contract basis. The payment to be made by the coal industry would depend on the number of trees and plants surviving. Moreover, by involving local community in such programme, the chance of its success would be brighter.

d) *Bridging Communication Gap between various agencies*

The author has observed a communication gap between State Government, Coal industry and local population. The local population rightly feels that their concerns as regards for depletion of ground water level, land degradation, Subsidence and blasting vibration are not shared by the industry. Voicing of these concerns are taken as 'Motivated propaganda of mischievous elements'. On the other hand, the industry feels that

<sup>5</sup> See T.E. Downing, J. Moles, I. McIntosh Ian and C. Garcia-Downing, Indigenous Peoples and Mining: Strategies and Tactics for Encounters, International Institute for Environment and Development (IIED), London, 2002; T.E. Downing, Avoiding New Poverty: Mining-Induced Displacement and Resettlement, International Institute for Environment and Development (IIED), London, 2002.



their limitations while operating in the competitive surroundings are not appreciated by the State Government and local population. It is necessary that a mechanism of interaction should be developed so that communication gap is bridged up and untoward friction does not lead to hampering of production of any mining unit.

e) *Establishing Commercial cum Industrial Complexes for Entrepreneurs*

There is considerable scope of establishing some industrial estate to fulfill the needs of mining projects and their employees. These may actually be linked to some of the big mining projects. Mining projects require lot of small and medium items and diverse service which may not be too sophisticated in nature. A survey may be made to assess the needs of mining projects of items and services which may be supplied by local entrepreneurs. Such services and facilities may be located in the commercial-cum-industrial complexes.

f) *Cess and Royalty on Coal*

Payment of cess and royalty by the coal company to the State-Government is dictated by the constitution and relevant laws. These payments are necessary both for infrastructure and general development undertaken by the State Government. But the structure of cess and royalty shall have to be so designed that coal from collieries in West Bengal does not become more costly compared to the similar grades of coal produced in other States. The factor has assumed special significance with imported coal getting into country's market in coastal areas of some States.

The whole problem should be viewed not on strict angle of law and statute but from the view point of development of coal industry in the state in which both the State Government and the coal company have mutual interest.

From the above discussion it is clear that for a sustainable development we have to take necessary steps in an instigated way.

The Rio Conference (1992) has made world population globally conscious of its responsibilities for the protection of not only their local environment, but to make it globally safe. The basic concept of "development has been that meets the needs of the present generation without compromising the ability of future generations to meet their needs". In this connection one may make again a reference to Brundetland report that said, "for non renewable resources, like fossil fuels and minerals, their use reduces the stock available for future generations". But it does not mean that such resources should not be used.. With minerals and fossil fuels, the rate of depletion and emphasis on recycling and economy of use should be calibrated to ensure that the resources do not run out, before acceptable substitutes are

found". Thus in case of minerals, more deposits must be found out, to maintain sustainable development for the present and future.

## V. CONCLUDING REMARKS

Mining is an extractive industry, which, by withdrawing the raw materials, creates anthropogenic land forms such as mine pits, soil tips and subsided lands and is general leads to land degradation. The most remarkable environmental changes in Raniganj and Jharia coal belts have been the removal of the tropical deciduous forest cover and changes in the surface run off and ground water levels. However, the greatest environmental impact of mining has been on the land itself. Mining has degraded the land not only by denuding it of its forest cover, and choking up the natural drainage lines, but has also destroyed the agricultural potential of this region.

The human dimensions of these physical impacts have been marginalization of the poorer tribal and scheduled caste groups from the mainstream, formal economy, displacement of peasantry and the growth of small scale, informal, illegal coal mining under local initiative. A degraded environment has fore closed alternative employment opportunities especially in the forestry and agricultural sector, leading the poorer people to criminal activities. This is so because environmental degradation has affected especially the common property resources such as land and water on which depend the subsistence and well-being of the poorer groups.

The extraction of coal by open cast and underground methods have created various anthropogenic landforms such as mine pits, spoil tips, overburden dumps, and subsided lands. The old abandoned quarries are usually 10-15 meter in depth and often contain water, which is of no use to the local communities due to its poor quality. The spoil dumps associated with recently abandoned quarries are usually unstable in nature, of great heights and much steeper slopes. A number of rain water gullies have formed along their side slopes and bring down the materials during the rainy reason. The rocky materials weather rather quickly in such dumps and several people have died due to rock fall while trying to extract coal or other material from them.

Several minor Drainage channels have been diverted from their original courses to facilitate the extraction of coal by opencast method. These are Nirsa, Mandman, Ghanashyam etc. In some cases the overburden dumps of the open cast collieries extend almost up to the channels of the drainage lines. In Pahargora, for example, a part of the Nunia nala (Stream) has been nearly blocked by the old spoil dumps.

Mining destabilizes the rock strata and, therefore, subsidence of surface land is inherently associated with it. More subsidence not only affects the area lying vertically above it but the surrounding areas as well. Indiscriminate and unplanned mining, leaving very small sized pillars and lack of knowledge or carelessness in the techniques of sand stowing had characterized the private mining operations in Raniganj and Jharia coal mining region. As a result, there are many old, abandoned and practically unapproachable mines, laying in either water logged or dry conditions in many part of the coal belt. In case of water logged mines, working of lower seams produce cracks which drain out the water into lower levels. This makes the ground even more prone to subsidence.

The air borne coal dust generated during different mining activities has been the main cause of health problem causing lung cancer to the miners and exposed over long period to the polluted environment. The studies conducted by CMRS in collaboration with Rajendra Medical College in 2004, Showed that 10.8% of all the miners and 12% of the underground workers suffering from pneumoconiosis in Raniganj and Jharia coal belt.

The Concentrated mining of coal underground in and around Raniganj and Jharia towns has transferred the underground pollutants to surface atmosphere. The mine exhaust through main ventilators and the return air ways added the gaseous and particulate pollutants to the surface atmosphere. Weathering of the coal and rock mass leaches from the dumps and noise menace from blast wave and movement of surface handling plants polluted the surface environment to variable degrees. The non mining activities like burning of coal in open stock, active fires and road transport of the coal have added a new dimension to the atmospheric pollution of the Raniganj and Jharia coal mining region.

Mining below the surface destabilizes the ground, while the process of mining particularly blasting causes vibration of the surface structures and noise generation. The transfer of the raw coal, its beneficiation and handling generates coal dust, while open burning of coal for steam or other usage release gaseous discharge to the surface atmosphere. The movements of coal from the pit head to the loading, or consumption points in open trucks or open wagons also add coal dust to the environment all along the routes. The air absorbing moisture from the underground workings often reduces the suspended particulate matter but the fumes of explosives, methane, SO<sub>2</sub>, and Oxides of carbon were added to the general body of air. The concentration of these hostile gases often creates negative impact over the surface and the population nearby. With the latest realization about the impact of these green house gasses over the ozone layer has drawn the attention of the global community and efforts

were on to drain methane and put it use as a fuel. The bio - diversity and the local people are also disturbed by the mining activities though they were mostly underground.

The toxicity of trace elements and complexities of biological and chemical interaction and its impact on health makes the study of trace element in the environment very relevant to the healthy living of the population. Most of these elements were present in the soil or rock mass but their concentration increased in the mining areas because of large scale lithosphere disturbance. The metals released with different mining and associated activities get suspended in atmosphere and get easy access to human body. In Raniganj and Jharia coalfield it has been observed that due to significant concentration of iron, lead, Zinc, Copper etc. creates havoc negative impacts over the plants and human life as well.

The hydrological cycle starting from the ocean to sky and ultimately precipitation to the earth is no exception for the Raniganj and Jharia coalfield where the rain, natural moisture and surface to sub surface water sustain biodiversity of the region. The infiltrated water is charged to the coal measure aquifers and is retained by the aquifuge. Depending upon the thickness, porosity, permeability of the rock mass, the capacity of the aquifers varied extensively over Damodar valley coalfields, The coal seams known to be impervious restricted the cross infiltration when different layers charged along the exposure served as the confined aquifers. The extraction of coal followed disturbance of the aquifers and lowering of the water table. In this process mineral leaching occurs, affecting the underwater quality. The water pollution problems in Raniganj and Jharia mining areas may be broadly classified into the following four major heads:

- Acid mine drainage due to sulfur content.
- Deoxygenation and Eutrophication of coal.
- Hardness of water due to lachets and,
- Heavy metal pollution, oil, tan and grease mixing in water.

The depillaring or long wall mining over critical area caused surface subsidence, cracks and fissure and lowering of water table. Soil erosion is prominent in case of thick seam working under shallow cover due of surface water sources starved the trees- sal, mahua, palas/ Bija, Kendu and Bhelwa etc. The surface cover slowly reduced to shrubs and bushes growing profusely in the rainy seasons and drying in winters. Bantuisi become the most common bush of the coal fields capable to sustain the particulate pollution because of the nature of the leaf. Forest as a result disappeared from Jharia and Raniganj coalfields even in the areas little under the influence of direct mining.

Opencast mining in the Raniganj and Jharia region has created deep depression and massive flat-

topped overburden dumps of sandstone and carbonaceous shale. These rocky materials have very little organic matter and need to undergo special treatment before they can be reclaimed and re-vegetated. Open cast mines have now become the largest agent for destroying and dereliction of land in Raniganj and Jharia coal belt. According to CMPDIL report (2012) approximately 55.5 Sq. Km. of land has become abandoned due to active surface and underground mining the land excavated in such mines is lost forever to the local community, stagnant waters of exhausted depressions either become a source of malaria or the water quickly dries up in summer and have little resource value. The dumps are regular death traps for local children who haunt the sites in search of leftover coal. The opencast mines have led to alternations in geomorphological, hydrological and biotic processes both at the local and the regional level, leading to the disruption in ecosystem development.

Large scale immigration is a common feature of all mining regions of the world. The sudden boost up of the economy of the Raniganj and Jharia coal belt too has attracted people from far away states of India like Madhya Pradesh, Haryana, Punjab, Orissa etc. Many of the male mining workers leave their families behind, establish temporary alliances with local women during their tenure and often retire to their homes. This outsider, temporary migrants have a superficial attitude to the environmental problems of the region. For them, the region's importance is in its coal resources which they are to exploit. They have no attachment to, and hence no concern for the land and environment of the region.

Environmental rehabilitation is one of the key process through which the environmental conditions could be modified in Raniganj and Jharia coal field region. The key to the success is preservation with the improvement of vegetation cover. Preservation of the top soil and its timely reuse are also the key points to achieve fast environmental rehabilitation. It is concluded by saying that rehabilitation of the mined-out areas needs care at all the stages for an encouraging result. Once convinced of the good results of the efforts the operational people will involve whole heartedly and the success of the rehabilitation can be ensured.

Remote sensing has been applied in respect of several resource themes; especially in coal mining areas this technique can be applied. In assessing the environmental damages in space and time caused by mining operations, a systematic survey and mapping is required. This is where remote sensing technique by its very favourable characteristics provides means of study for overall identification of problems and applying environmental protection measures.

Environmental Impact Assessment (EIA) is a concept that evolved in search for ways to render development and protection of the environment. In order to predict and assess the impacts associated with a

proposed action, it is necessary to describe the environmental setting in which the proposed action takes place. This gives the baseline information against which prediction and assessment can be made. Here author tries to mention about the environment which has been degraded by coal mining. Now a day's environmental assessment is widely used to study the impact which is still continuing in the particular area by particular activity. Increasing demand for environmental quality, protection of scenery, clear air and water, minimization of noise congestion and open space for active outdoor recreation have all taken with key importance. An impact can be defined as any change in physical, chemical, biological, cultural and socio-economic environmental system that can be attributed to human activities.

Raniganj and Jharia coal mining region plays an important role in countries overall development. This region has well developed transport and communication and rich in mineral resources. This famous coal bearing region has got very well scope for large industrial development along with other developments of agriculture, livestock, forest, water and other minerals. An integrated approach is very necessary for a sustainable development in this region.

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, adaptation of eco-friendly coal mining process and a forestation in the mining site etc. can really minimize that damage to the environment.

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