CHAPTER II
CONCEPTUAL FRAMEWORK AND
LITERATURE REVIEW

Introduction

Mining is indispensable for the individual, for the society, and for the
development of the nations. Unfortunately, mining procedures and operations
are often associated with health hazards and environmental deterioration.

The profession which deals with anticipating, recognizing, evaluating and
controlling any workplace related health hazards, agents and factors is
occupational hygiene. "It is but a sad profit which is achieved at the cost of the
health of workers..." (Goelzer, 1996) One aspect of harmful and hazardous
conditions at the mine (or any work place) may result at macro level appreciable
financial loss due to the burden on health and social security systems, to the
negative impact on production and associated environmental costs.

The airborne dust in the coal mines and suspended particulate matter has lot of
contribution in polluting air.

A study by (Thote & Heath, 2004) views, "Increase in degree of mechanization
in opencast mines adds enormous pollutants to the environment. Due to
degradation in air quality, human health comes under the fear of rapid increase
in occupational diseases to the workers involved in this industry. Besides toxic
gases, a major contribution to air pollution is from the SPM (suspended
particulate matter). Airborne dust is part of the SPM. In opencast mines,
majority of the operations produce dust.

Dust particle of less than 5 mm is known as respirable dust. Respirable dust is
physiologically very harmful and its toxicity depends upon the toxic components

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9 Goelzer B (1996). The 1996 William P. Yant Award Lecture; The harmonized development of
occupational hygiene - a Need in developing countries. American industrial Hygiene association journal
57: 984

Indian Mining and Engineering Journal 43 (7): 31-35
of the aerosol cloud, its chemical, physical, and biological composition in addition to its size. Diseases caused by dust come under the purview of occupational diseases as defined by the International Labour Organization.

While discussing health in general terms let’s see first what is ‘Health’ according to internationally acclaimed apex body working in this direction. According to international standards health doesn’t mean only physical health or no disorder but it has a broader meaning than this. The World Health Organization (WHO) defines health as: “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. This definition suggests that health is a positive concept to which governments, statutory agencies, voluntary organizations, businesses, communities and individuals can all contribute, and that people’s sense of well-being can be poor even where there is no identifiable disease. The environment, income, employment, the organization of transport, the design and condition of houses, crime and the social and physical condition of local neighborhoods all contribute to good and poor health. Health impact assessment identifies how a particular proposal, project or plan will alter these determinants and assesses the likely impact on the health of different groups in a population.”(WHIASU, 2004)11

Dust as a Health Hazard:

The available knowledge on hazard prevention and control is not yet adequately and universally applied, for instance although a disease called silicosis which is common for granite quarry workers or other similar mines (even coal where drilling operation is done for blasting purposes) is known for centuries but dusts containing free crystalline silica remains uncontrolled all over the world, mostly but not exclusively in developing countries like India where mining and quarrying is rampant.

11 WHIASU (2004); (Welsh Health Impact Assessment Support Unit) Health Impact Assessment of the Proposed Extension to Margam Opencast Mine and National Public Health Service for Wales on behalf of the Margam opencast and Health Steering Group pp.3-4 and p.20
There has been instances where control was attempted with significant success like, “In the British coal industry, improved dust control methods from 1940’s to the 1970’s struggled to contain the extra dust produced by rapid mechanization, but nevertheless the respirable dust concentrations overall were reduced by a factor of three. (Jones, 1979)\textsuperscript{12}

Dust at the mine place can be a health hazard for the mine worker by affecting health in many ways. The routes of exposure may be through skin. Many dusts cause dermatosis or even skin cancer but this is mainly heard to be caused by cement. Dust need not be airborne and of any size has health significance. Through skin it may cause allergies of many kinds.

Airborne dust has good chance that someone will inhale it and if it is of harmful kind, there is chance that he will suffer from an adverse health effect which may range from some minor impairment to irreversible disease and even life threatening conditions, if there is a prolonged exposure.

Coal miner’s pneumoconiosis is a serious problem in many countries where coal mining is appreciable. The ILO definition of pneumoconiosis is: “pneumoconiosis is the accumulation of dust in the lungs and the tissue reaction to its presence”. (ILO, 1997)\textsuperscript{13}

Where strict prevention and control measures have been well established, this does not occur. For example, in Australia, where coal mining is a major industry, there has not been a new case of coal miner’s pneumoconiosis in the last ten years, due to strict enforcement of occupational exposure standards and compulsory medical surveillance of all workers in the industry every two years. (PACE, 1999)\textsuperscript{14}


\textsuperscript{14} PACE(1999) Report on “Airborne dust” by Prevention And Control Exchange ; Occupational and Environmental health; Department of the protection of the Human Environment; WHO; Geneva; pp- 23
SKCF - EASTERN PROJECTION

Haphazard OB Dumps

2003

FIG. 6.16
consulted. Actual visit to the area of concern will provide detailed observation. A pure scientific approach can be an epidemiological study, to establish exposure-effect relationship. A Social scientists or a Geographer’s approach to study mineworker’s health hazards can be different in approach. For instance, findings and analysis can be based on the direct response of the concerned or effected groups. It can be also an analysis of available data from secondary sources to show changes over time and space.

**Environmental Approach:**

For hazard detection and prevention, the environmental specialists have developed the cleaner production approach (UNEP, 1993) which not only protects the environment but also mineworker’s health; the link between the two is irrefutable. It is a matter of concern and should be a policy matter that, if coal mining is inevitable for our industrial and domestic sectors and also for our economic growth, then it is equally important that from the extraction till consumption the strategy should be environment and health friendly ways and techniques.

**Method for Dust Control in the Coal mine**

**Wet Methods:** One very common method adopted to curb dust in the mine area is wet method which involves wetting down the dusty parts. Wet drilling, water spraying at points of dust generation, wet cleaning of the floors and work surfaces, and use of stabilizers for stock or stock or waste piles.(Belle and Ramani,1997) Wet methods are, therefore efficient when water is introduced at the point of dust generation, so that the particles become wetted before having a chance to disperse into ambient air. In coal cutting as well as drilling, this can be achieved by feeding water through the tool bit and unto the cutting face. However even after wet drilling, there can be possibility that, dust is not completely wetted due to insufficient water in the drilling hole etc, therefore air

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in the breathing zone of the workers should be monitored and, if needed, ventilation and/or personal protection can be used.

There can be increase in heat stress caused by increased humidity due to wet drilling in the areas of hotter climate.

Another study by (Kumar et al, 2004) suggests the option of routine check-ups, “The RCM (Routine Condition Monitoring) is an essential process to check the condition and performance of machines and equipment deployed at coal mines.

Potential faults can be detected at an early stage and the remedial action taken, thereby minimizing the risks of breakdown and safety hazards. The RCM measurements can be used for commissioning tests, Routine monitoring record, maintenance, and fault diagnosis and can prove to be very effective for the equipment being used in hazardous conditions”. In this paper, the objective and methodology of the RCM is described.

**Coal Mine Fire**

Spontaneous heating/fire of coal is common problem in various coal-producing units in Jharkhand. Spontaneous heating in the underground has been attempted to be explained and a methodology has been suggested for its prevention by (Sahay et al, 2004) "Occurrence of spontaneous heating in coal pillars is one of the most feared hazards in underground coal mines. It may turn into serious conflagration and pollute the entire atmosphere in the mine in a very short time. To prevent/control such fire, knowledge of air permeability of a particular pillar will be useful.”

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Coal exposed to atmosphere reacts with oxygen (air) and catches fire sooner or later. In India, 75% of Coal Mining is done in opencast mines and if the mine fire is controlled in the initial stage or proper precautions are taken then such incidences could be prevented from happening.

"Under a science and technology project funded by the ministry of coal, government of India, CMRI (Central Mining Research Institute) has developed a fire-protective coating having properties such as good fire resistance, ease in spraying, no development of cracks, resistance of air to permeation, and no sealing off from the coal surface. The Jhingurdah colliery authorities took interest in this material, and it has been successfully applied in the coal benches of the Jhingurdah opencast project." (Singh et al., 2000)

The paper describes the results of the application of fire-protective coating material on the most prone coal benches of the Jhingurdah opencast project. The paper concludes that application of this coating material at the right time to coal benches can totally prevent spontaneous heating. Hence, valuable coal can be saved from spontaneous heating/fire.

After realizing the need, the authors have developed a methodology for measurement of air permeability of coal pillars. In this paper, definition of air permeability, its unit, and methodology for measurement have been briefly discussed. Results of investigation in one mine for determination of air permeability of a coal pillar using the methodology already show that the air permeability is fairly constant in both intake and return sides of a pillar. Further, air leakage is linearly proportional to pressure differential, which proves the validity of equation.

**Need for clean Coal**

India is the third largest producer and consumer of coal in the world.

Our coal generally has high ash content and therefore from the expected environmental impacts, technologies for cleaning coal before combustion need to be developed.

A study by (Gupta, 2000) focuses on the need for clean coal production and the benefits associated with it, he says, “Although the country is rich in coal reserves, the generally inferior quality of coal will lead to its depletion if it is not used cleanly. Increasing the proportion of prepared coal from the current level of less than 5% (i.e. 10-11 million tones per annum) of all coal consumed will lead to a massive saving. This can be achieved if new washeries are set up, preferably near to the coalfields.”

This idea of cleaning coal at it extraction site has though economical and other associated benefits but the waste from the washeries should not enter the sub channels or a main river channel which may have far fetched adverse impacts on the ecological environment and human health in the catchment area.

The present study has been attempted from a Geographical point of view and the dynamics of the environment of the coal-mining region has been focused upon while keeping in mind what Gerasimov has said, “The purview of ecological approach has been enlarged to digest relevant information and results of studies in biology, sociology and anthropology etc. under such a changed set-up, Geography has equally emphasized aspects of spatial variation and relationship and biological science are no more the sole custodian of ecological approach it has rather displayed a well marked tendency to become in other fields of science”. (Gerasimov, 1980)

Many studies have come up with issues related to harmful effects of mining and how trace elements influence the local environment and may affect human health in the vicinity of the mining area.


One such study by (Singh, 2003) attempts to ascertain the harmful effects of coal mining on human health in the adjoining areas of a colliery. The work has been aimed to determine the levels of copper in surface and subsurface waters of Rawanara Colliery area and to determine possible toxicological impacts on human health.

This study has been conducted on the basis of collection and analysis of water samples from pench river and hand pumps, wells, and near the mine area in pench valley in Madhya Pradesh (22° 10' to 22° 15' N and longitude 78°46' to 78°55' E) on survey of India toposheet No. 55 J/16. High concentrations of copper in a coal mining area. (The findings were from the analysis of the samples done on Atomic Absorption Spectrophotometer (AAS).)

The study found, “copper in high concentration in the coal seams of the study area and also in above permissible limits in the collected samples and it was concluded in the study that the coal mining activities in the area were the main source of copper dispersion into the aquatic environment and the majority of surface and sub-surface waters of this mine were not suitable for day to day need and long term exposure may likely to cause a severe health hazard problems in the area.” (Singh, 2003)

Copper is ubiquitous in the earth's crust. The presence of copper in plants and animal tissues was recognized more than 150 years ago. The role of copper in human health is a complete enigma while some studies have shown unequivocally that “a deficiency of copper can lead to high serum cholesterol and an increased risk of cardiovascular diseases.” (Reisar, et al. 1987)

Where as “excess copper causes neurological complaints, hypertension, liver and kidney dysfunction, cancer and accelerated ageing.” (Pfeiffer and mailloux,

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25 ibid

Further research is required to be done in other coal mining areas also to observe effect of copper present in the waters of the coalmine sites and in the adjoining rivers/streams.

The adverse effects of the coal mining can be scientifically ascertained by analyzing the trace elements found in the concerned locations. If they exceed the permissible limits then are supposed to be harmful otherwise they are in the acceptable limits.

Another study by Sreekesh and Sinha, 2002 has revealed that operator’s of various heavy machineries in mines are exposed to dust beyond the accepted limits.

“In mines, loading, unloading, drilling, blasting and truck/ dumper movements on haul roads are the main source of dust. Operator’s exposure to dust levels is reported to varying from 0.87 to 5.68 mg/m³. The drill and chute operator’s are exposed to dust levels higher than the standard SPM concentration along the road corridors is estimated and it exceeds the ambient air quality levels.” (Sinha and Sreekesh, 2002)

**Natural Resources Exploitation**

Different regions/nations are reaping the adverse consequences of growth – generated activities in various forms as a result of modern technology based development.

In many cases natural resources such as minerals are mined to the last limit. Mining is one of the chief economic activities in the Chotanagpur region.

Though successive governments have been largely benefited from the abundant mineral resources of this region but little attention are paid to environmental considerations whose negligence often leads to degradation of the environment and sometimes directly and drastically affecting the surroundings.

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In Dhanbad “The reckless mining by the BCCL (Bharat Coking Coal Ltd.) which owns the right of mining in Jharia caused Chasnala or Gajlitand disaster. In this incident, land subsidence took place and Cracks developed in the houses of the entire area of Husainabad locality of Jharia”. Though the finer points of the cause of such land subsidence could not ascertained, it is almost certain that it was caused due to the heavy underground blasting of coal in the Jharia coal field.

Global initiatives: “Think global act local”

Before 1970s there were very few laws on environmental protection and environmental problems were considered as local and regional problems. Since then the internationalization has been growing and the need for global environmental solutions has become even more important. Since then on UN’s initiative a number of summits on the environment have brought many countries together to discuss the various environmental issues.

1) Stockholm Conference 1972

United Nations Conference on the Human Environment was held in Stockholm, Sweden. Representatives from 113 countries met to “consider the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment” (UNEP, 2004). This was the first time when relationship between economic development and environmental degradation was given attention. Thereafter happened the formation of United Nations Environment Programme (UNEP)

2) Brundtland Report 1987

“Less than 20 years ago the club of Rome confidently forecast a shortage of all raw materials under the pressures of exponential economic expansion .The scarcity of basic materials was predicted to become so desperate by the mid

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1980’s that the modern industrial economy would not only cease to grow; it would collapse (Meadows & Meadows, 1972)\(^{31}\). It did not happen as was predicted but the search for ‘Sustainable development’, popularized by the 1987 Brundtland Commission report on the world environment and economic development reflects anxieties about scarcity. (UN, 1987)\(^{32}\). In 1983 the World Commission on Environment and Development was formed by the UN lead by G. Brundtland, and the commission presented its report named “Our Common Future” in 1987. The Report defined sustainable development, “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”. Since then the concept has been the central viewpoint of all environmental debate. (UNEP, 2004)

3) Rio Earth Summit 1992

The United Nations Conference on Environment and Development (UNCED), also known as the earth Summit, was held in Rio de Janeiro, Brazil, in 1992. The Conference resulted in a number of agreements. The Rio Declaration on Environment and development contains a number of principles defining the rights and responsibilities for States. In this declaration the “precautionary approach” and “polluters pay principle” were first mentioned.

The comprehensive action plan Agenda 21 is an international environmental programme for sustainable development with the message “think globally, act locally”. The United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity, and the Statement of Forest Principles were signed at the UNCED. In addition the United Nations Commission on Sustainable development (UNCSD) was created in 1992, to follow up the UNCED and the implementation of Agenda 21.

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4) Johannesburg Summit 2002

Representatives from 190 countries met to talk about sustainable development issues and to pursue the outcomes of the UNCED. They also made a consensus on further action to implement Agenda 21. An important question was how to reduce the poverty in some parts of the world while creating a sustainable development. Commitments were made to increase access to safe drinking water and proper sanitation, to increase access to energy services, to improve health conditions and agriculture, and to better protect the world’s biodiversity and ecosystems.

5) Kyoto protocol

In 1997, the nations of the world strengthened the existing climate treaty by agreeing to the ‘Kyoto Protocol’ that requires the industrialized countries to cut their aggregate emissions by over 5% below 1990 levels before 2008-12.

Environmental awareness in Indian coal industry was evident only in the early eighties. In June 1991 a “round table conference” was convened in Berlin, which adopted an action plan called “Berlin Guidelines” for mining and environment.

This was further deliberated in a seminar on ‘Environmental Management for Mining and mineral resources Development’ at Bangkok in September, 1991. The 12th mining congress held in New Delhi in 1994 and 19th world mining congress (also world mining expo concurrent with the congress) held in November 2003 carried forward the environmental concerns in mining.

At present, our policy framework for managing our environmental resources depends almost entirely on direct regulation - the ‘command and Control’ approach to reconcile private activity with the public interest. “It does almost nothing to bring market incentives to bear on the conservation, protection and enhancement of these resources.” (Pearse, 1991)\[33\].

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Here, of course, market processes cannot resolve all management problems and there are so many imperfections in the market, especially for mineral resources, that there will always be need for regulations but the market forces can be effective that we cannot and should not ignore.

A myriad of new legal, financial and institutional rules are emerging at the international level, in addition to proliferating national laws, to promote sustainable development in mining. The new rules are especially focused on protecting and reinforcing sustainable development in the resource-based economies of developing countries.

An incisive conclusion is derived from two scholars, "Because environmental regulation is here to stay and bound to become more widely adopted, more stringent and better enforced, the winners in the division of share in the metals markets will not be those firms that avoid environmental control (only later to be forced to internalize the high cost of having done so), but will be those firms that were ahead of the game, those that played a role in changing the industry's parameters, and those that used their innovative capabilities to their competitive advantage." (Prince & Nelson, 1996)

The costs of environmental damages do not enter into the conventional techniques of project appraisal. This failure leads the economy towards unsustainable path. Thus, for sustainable economic development, incorporation of environmental issues in the social-cost benefit analysis is necessary.

Mining Projects and Environmental Impact Assessments

Globally, the Environmental Impact Assessment (EIA) refers to the process of identifying the possible environmental impacts of the planned activity and to suggest methods to minimize them. The report on the EIA is called "Environmental Impact Statement" (EIS) and describes the results of the assessment.


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"An EIA is generally required by the law when applying for any kind of permit from the environmental authorities to start up a new activity. The requirements for EIA were first introduced in the National Environmental Policy Act, NEPA, in the United States, in 1969" (Lister, 1996). Since then the requirement for EIA, has been introduced in most country’s environmental legislation in one way or another. There is no general definition of EIA and the procedure and requirements vary from country to country. The far-reaching objective is practically the same everywhere; to distinguish and describe possible environmental impacts from a planned activity and to some extent, suggest methods, to reduce the negative impacts.

Environmental Impact Assessment (EIA) or Environment Management Plan (EMP) is a prerequisite for the mining projects but the proceedings should not lack transparency. Public consultations are a better way to take decisions than being taken in closed doors.

**ISO 14001**

The ISO 14000 family of environmental standards was developed by International Standardization Organization, ISO. The first of the ISO 14000 standard was published in 1996 and the standards are developed so that they can be introduced in any type of organization in either public or private sectors (ISO Central Secretariat, 1998). The family includes a number of standards for environmental work and ISO 14001 is the EMS standard. In December 2002 more than 46000 companies around the world were ISO 14001 certified (Koichi, 2002). ISO 14001 contains 52 requirements, which the organization must fulfill to obtain a certificate.

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Strategic Environmental Assessment (SEA)

It is one of the most recently developed tools for environmental management and is a way to carrying out EIA at a more strategic level of development – at policies, plans and programmes. “The formalized, systematic and comprehensive process of evaluating the environmental impacts of a policy plan or programmes and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making.” (Persson, 2003)37

The Environmental Impact Assessment (EIA) legislation and procedure may vary from one country to another but the underlying theme is: potential impacts of certain mining projects must be assessed and documented during the planning stage itself. EIA, if carried out correctly is a powerful tool to achieve acceptable environmental conservation as well as sustainable mining activity development.

There is certainly not unanimity as far as the ongoing discourse on economic and environmental sustainability of mining activities is concerned. (Crowson, 1997)38 puts it in a somewhat different manner; “The mining industry currently finds itself increasingly squeezed by environmental concerns, covering the whole range of operations from grass-roots exploration to final end-use of mineral products. This development may be inextricably linked to rising standards of living, and the associated trend towards paying more attention to the quality of life, as basic material needs gradually become satisfied. Rich societies can afford to minimize the disruptive impact of development on the environment, even to the extent of foregoing the financial benefits of that development. The same standards cannot, however, be applied in countries still blighted by poverty and disease; such impositions by well-meaning elements within rich countries are resulting in negative side effects, not only for the

37 Persson J. (2003) Environmental Impact of mining in a European Context; Master of Science programme; Department of Environmental Engineering Management Group; Lulea University of Technology; Lulea (Sweden)
38 Crowson, P. (1997) mining During the next 25 years: Issues and Challenges; Natural resources Forum; vol.21, no.4, pp.231-238
mining industry. The industry has to adopt the highest possible health, safety, and environmental standards that are consistent with its long-run viability, wherever it operates. It constantly has to distinguish between extreme views and reasoned legitimate concerns. It can, and should do no more."

The study done by (Misra et al, 1986)\(^{39}\) attempts to highlight the importance of land water and mineral resources, and their degradation, causing threat to human existence in some areas. The study highlights the increasing pressure of population on natural endowments and the recent developments in technology have given man, tremendous power to exploit the natural resources indiscriminately.

Increase in population in the last century has created manifold complex problems of environmental degradation. India’s population is growing at a rate of more than 2 percent a year. Further, per-capita availability of arable land is declining. And in view of the expanding demand for water for non-agricultural purposes, water is becoming a scarce resource and already facing acute degradation stress.

Concerted efforts must be placed on scientific land use planning for judicious exploitation of the coal resources.

India’s present population has crossed the one billion mark. “This implies that the per capita cultivable land holding is 0.14 ha and will be 0.1 ha in 2020 A.D. More then 50 percent of the geographical area of the country is beset with different types and degrees of land degradation problems.”(Paroda, 1977)\(^{40}\)

“The twin-character of space and environment is mainly caused by the fact that environmental externalities unpaid burdens imposed by the pollutants on others – are usually transmitted to others (individuals, cites, regions, continents,


\(^{40}\) Paroda (R.S): (1977) Options and Property Areas; The Hindu Survey of Indian Agriculture; 1997; pp. 13-18 (Dr. R.S. Paroda, Secretary DARE, and Director General, Indian Council of Agricultural Research.
ecosystems, etc). Though the medium of space. In other words environmental externalities tend to show-up as spatial spillovers; there is hardly any situation in which polluters would spoil their own living area. This means essentially that all the space related activities (e.g., residential patterns, locational structures, transportation flows etc.) are directly related to the existence or origin of environmental problems.”(Nijkamp, 1997)\footnote{Nijkamp, P: (1997) Environment and the Space Economy, Indian Journal of Regional Science, vol. XXXIX 1997, no. 1.}

**Depletion of the Forest Resource:**

According to forest survey of India (1991) the actual forest cover is 63.99 million ha (11.71%), of which only 38.50 million ha. consists of dense forests (crown density 40 percent and above) and 24.99 million hectare is open and degraded forests (crown density 10 to less than 40 percent). There has been depletion of forest at a rate more than its replenishment. In India forests have depleted at the rate of 47500 ha/year during 1976-77 to 1988-99 period has been only at the rate of 28,000 ha/year.

The Coal Mining has adversely affected forest resource and the local inhabitants now have limited access to their common property resources, the land, water bodies and forest resource that belonged to them as they are shrinking down.

Few western Scholars bear this belief that whatever alteration has taken place to the environment of Chotanagpur plateau is more the contribution of the indigenous people and government has lesser role played in it.

“The inhabitants of the Chotanagpur region and new settlers in this region has directly or indirectly, deliberately or inadvertently/unintentionally or accidentally, has affected and modified the environment of this region. That maybe through activities such as deforestation for domestic, agricultural and industrial purposes, forest fires, mining activities etc. has done a great and irreparable damage to the forest resources of this region. But there has been
several attempts by state government or central government or other agencies to replenish the forest resource of this region and to maintain the equilibrium or the symbiosis of the man environment coexistence” (Arnold, 1990).42

Such views seem to be conveying only fractional truth and are intended to blame the people, rather the governing bodies and other agencies for all the wrongs that has been done to the environment. Moreover in a highly biased note, it doesn’t find any failure on the part of governments/ agencies at planning level decisions. The role of governing bodies has been praised for the replenishment of the depleted resources.

Well, if there has been an attempt on the part of the government then why satellite data shows it otherwise. It may be partly true, that government and other agencies have tried forest replenishment efforts but they were hardly successful in most cases, and it is also true that the depletion of forest resource itself has been mainly due to the connivance of contractors with local administration and also non implementation of the environmental guidelines.

Studies have shown that, agencies of development have a role in destabilizing the ecological balance.

“Modern agencies of development and patterns of resource utilization are largely responsible for disturbing the ecological balance between physical and cultural systems of landscape in tribal dominant habitat, such as Damodar, Mahanadi, Narmada and Son basin or peninsular uplands as also the Himalayan habitats of unprivileged people.” (Singh, 1986)43

The loss of forest on account of extravagant Subarnarekha Multipurpose Project (SMP) is also an instance of so-called development being anti-environment. The clearing of forests much in excess of the mining requirements by the captive


mines of Bokaro Steel Plant at Kiriburu is another example of Wanton of forests that is being condoned by the government. The denial of employment to the local tribals on large-scale in many of the mining and industrial units situated in Jharkhand further augments the antipathy of the tribals and prompts them to destroy forests for their livelihood.

**Coalmine Environment and Health hazards to the Mineworkers**

People who work in the Opencast (OC) or Underground (UG) mines also feel that environmental conditions are not very suitable for human health.

The occupational requirements in a coalmine is to face the adverse conditions like Dust, Noise, Gas, Vibration (due to Blasting work) adds physical stress as well as subsequent mental stress to the mineworker.

The dusty environment in a mine is mostly caused by various extraction and transportation procedures e.g. drill operation or heavy vehicular movement on the poorly built haul roads which are full of mud and coal dust) and vehicular movement makes the environment of the entire area dusty and there is increase in the suspended particles in the air.

**Blasting in opencast coal mines**

Human response to blast induced vibration and air overpressure is an unsolved problem accompanied with the mining process. This aspect has been covered by a limited number of researchers and least in an Indian context.

Human response varies from person to person depending on various factors like age, sex, literacy, health and exposure to mining. With ever increasing demand for minerals opencast mines will transgress towards habitats, wherein these problems of noise, vibration due to blasting will be more acute. (Chakraborty, et.al 2003)\(^4^4\)

\(^4^4\) Chakraborty H.A; et. al (2003) Human response to ground vibration and air pressure due to blasting in opencast non coal mines- a case study; The Indian Mining & Engineering Journal; April-May 2003; pp-15-26
Human body is very sensitive to the vibration that may be of very small magnitudes. Although sensitivity to vibration varies significantly between individuals, a person will generally become aware of blast induced vibration at levels of around 1.5mm/s (Wiss, 1968)\textsuperscript{45}. He explained the level of vibration and the corresponding human response which are presented in the table 2.1

Table 2.1

<table>
<thead>
<tr>
<th>$V_{max}$ (mm/sec)</th>
<th>Level/Degree of Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08-0.20</td>
<td>Threshold of perception</td>
</tr>
<tr>
<td>0.20-0.51</td>
<td>Barely noticeable</td>
</tr>
<tr>
<td>0.51-0.97</td>
<td>Noticeable</td>
</tr>
<tr>
<td>0.97-2.03</td>
<td>Unpleasant</td>
</tr>
<tr>
<td>2.03-3.3</td>
<td>Disturbing</td>
</tr>
<tr>
<td>3.3-5.08</td>
<td>Objectionable</td>
</tr>
</tbody>
</table>

Where $V_{max}$ = Peak particle velocity

Mine Blast Induced vibration can be disturbing to the inhabitants of the nearby settlements of the mine area. (Pal Roy, 1996)\textsuperscript{47} concluded that human response to vibration could be categorized into following classes.

1) Curiosity
2) Concern
3) Fear

\textsuperscript{45} Wiss (1968) Effect of blasting vibrations on building and people, Civil Engineering, ASCE, pp. 46-48
\textsuperscript{46} ibid
He concluded that above factors might also be referred to as psychological response. Beside above factors, vibrations are major influencing factor to human response. Based on subjective sampling in various villages, he has prepared a generalized chart for an approximate scaling of human response to vibration presented in the Table 2.2 below.

**Table 2.2**

**Human response to particle velocity**

<table>
<thead>
<tr>
<th>Response</th>
<th>Particle velocity (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noticeable</td>
<td>0.5</td>
</tr>
<tr>
<td>Troublesome</td>
<td>5</td>
</tr>
<tr>
<td>Severe</td>
<td>15</td>
</tr>
</tbody>
</table>

*(After Pal Roy, 1996)*

**Coal Mining and affects on Indigenous communities**

In the past, before 1971, coal mining was mainly done by private firms. Vast tracts in the coal bearing areas of Damodar valley have been acquired and turned into wastelands by haphazard mining. After nationalization of the coal industry in 1971 (coking coal) and 1973 (Non-coking coal), coal mining is mainly done by CIL and its subsidiary companies. Even after nationalization much illegal mining by private contractors, is going on in Jharkhand.

In Jharkhand, due to mining indigenous communities, which are mainly, original settlers or the tribals of the state have faced displacement. These people have been hardly been paid back rightfully as they themselves hardly understand and know their rights. This is the reason that they have always been subject to injustice.

48 ibid
There are a few countries, which have recognized in varying degrees, the rights of indigenous peoples to their ancestral lands (Australia, Papua New Guinea, Colombia, etc). Papua New Guinea, which still has 97% of its lands officially, recognized as customarily owned lands. However, this law is increasingly threatened because governments are bowing to the demands of transnational mining and logging corporations to permit the alienation of these lands.

There are also countries, which do not, as yet, have any laws recognizing the ancestral land rights. Ancestral land rights defenders generally assert that indigenous peoples have rights to the lands, which their ancestors had occupied since time immemorial, and these rights include rights to resources above and under such lands.

The concept of 'ancestral land rights' does not set up a dichotomy between surface rights and sub-surface rights. Thus, it includes rights to the mineral resources. In countries where such rights are recognized, the indigenous peoples demand royalty payments from either the mining corporations or the state, which makes use of their ancestral lands for mining.

The history of mining is a history of land appropriation and displacement of people belonging to the lower economic sectors of society. While mining has negative impacts on all those who live in the mining communities in general and those who are affected by the mining operations. Generally, mining operations have socio-economic, health, and environmental impacts. Appropriation of the lands of indigenous people, results in massive displacements of people. Coal mining industry is one of the major causes of land alienation and displacement of the indigenous communities.

Large-scale destruction of lands, mountains, forests and agricultural lands, which includes erosion, siltation, deforestation, desertification and flattening of plateaus.

There is pollution of soils and rivers with toxic chemicals used in the extraction and processing of ores and with the toxic mineral by-products of the mining
process. Air pollution is generated by the dust coming from continuous blasting, drilling and transportation of coal.

Frequent occurrences of mining accidents, ranging from the collapse of underground tunnels to the bursting or overflowing of mine-tailings dams, which have caused the further pollution of lands and rivers.

The mineworkers, the people in the mining communities, and even those who are at the receiving end of toxic mine-tailings, are faced with serious health problems. These include skin diseases, respiratory diseases.

Occupational hazards and accidents leading to lifelong physical disabilities are becoming more frequent among the mineworkers because of the poor and high-risk working conditions.