CHAPTER I

INTRODUCTION

Introduction

The mining industry is one of the three basic industries in the primary sector, the other two being agriculture, and wildlife and fisheries. Unfortunately, the general opinion of the mining industry is often associated with the accidents; disasters and environmental degradation related to mining and particularly coal mining. Certainly, there are reasons based on incidents for such opinions expressed by the people. Mine disasters receive wide coverage from the media, whether it is an explosion or mine fire or inundations, the lives of people are touched by the personal and societal impacts of these events.

In most of the cases enquiries, after these disasters happen, do not deny the fact that the disaster situation was present and could have been detected with thoughtful search. In many cases human error has been found to be the immediate cause, but it could have been avoided, if the management and planning had been more efficient in their approach.

In June 2005 it was reported in a national newspaper\(^1\) that fourteen miners were trapped inside a mine at the central Saunda colliery in Hazaribagh in Jharkhand after water gushed in and roof collapsed. About three million gallons of water rushed into the mine of the Central Coalfields Limited (CCL). Any rescue operation could be carried out only when water was thoroughly pumped out, which took almost a week. The outcome was absolutely no chances of rescuing the trapped miners back, alive.

Apart from the mining disasters, coalminers too are subjected to certain potential health hazards, such as dust, gas, noise, vibration which may not manifest in the form of any immediate danger but sooner or later it may cause grave negative impacts on human health as many studies and researches have shown. Our

---

\(^1\)“Mine roof caves in, 14 trapped”, Hindustan Times, New Delhi: June 15, 2005
detection of the potential health hazards for the mineworkers in the mine area is limited only to the extent of present level of medical advancement. As the new studies come up, they reflect certain new perspectives about influences of mine environment on mineworker’s health. Of course human civilization has come a long way from the past when technological advancement was less and so were the medical facilities particularly in the last two centuries.

Mine is one of the oldest human occupations. The awareness of occupational illness associated with mining is evident from the writings of Hippocrates (460-370 BC), Pliny the elder (AD 23-79) and Galen (AD 131-210). Georgius Agricola (1494-1555) refers to the diseases of miners and the need for their control through good planning and operating practices, and responsible management. (Schwerha, 1989)² If we take last hundred years or so we will find that, knowledge of the potential damages to health from breathing heavily dust-laden air in the mine environment has increased.

The health effects due to breathing high concentrations of respirable dust in coal mines are slow to develop and can only be controlled by checking high dust concentrations in the mine and making changes in the method and planning for the coal extraction procedure. Professor Ramani, the Head of the Department of Mineral Engineering in Pennsylvania State University holds the view that “The adverse health impacts in coal mines can be slow and long term in developing but once afflicted, debilitation can be progressive and horrific. The specific conditions are most important in determining and controlling the health hazard.” (Ramani, 1995)³

Mechanization of mining process has not contributed significantly in reducing the risk of health hazards to the mineworkers and has resulted in upsetting the environment in our coalmines. “Mechanized mining systems offer high

---

production and high percentage of recovery with improved productivity. But they produce gases and dust at higher rates. Employees of such mining systems are exposed to many health hazards due to high dust concentrations. Even in underground coal mines an airborne dust survey showed that the dust concentration levels at many places, such as where blasting is done, are beyond statutory limits.” (Sastry & Vardhan, 2000)

The coal mining process affects adversely not only its immediate environment but through river channels and air transportation, dust particles can travel quite a distance from the mine area.

According to Jones (1993), “The majority of coal-related projects have the potential to affect the environment to a significant degree. Open cast methods of coal extraction can directly affect terrestrial and aquatic ecosystems.”

Some of the problems creating elements are as under:

1) Air Pollution: In the coalmines the undesirable consequences of air pollution cover a very wide spectrum ranging from material damage to personal discomfort and illness. Though, the stress is visible but exact evaluation of its effects is a complex and difficult task. The occupational health hazards include inhalation of polluted air by any inhabitants in the vicinity of the coalmines in general and mineworkers in particular.

2) Water Pollution: Solid mine refuge e.g. slag heaps, coal dust, mine tailings on land, etc may join the streams. They get dissolved in the rain water and also percolate and contaminate ground water. In Jharkhand fine suspended particles from coal washeries may choke and pollute rivers, e.g. combined with the related industries the multiplier effect of coalmining has severely polluted Damodar river and its other tributary channels near Bokaro, and Dhanbad towns. The water pollution affects people who use such water for drinking, bathing,

---

4 Sastry VR and Vardhan H (2000) Dust problems in mechanized underground coal mines – a critical study; The Indian Mining & Engineering Journal; 39 (12); pp-48-55
washing or any other purpose. It also reduces fish catch and may contaminate fish further resulting in the spread of bone diseases and arthritis among those who consume them.

3) Noise Pollution: Noise is an inescapable by-product of industrial environment. Coalmining is no exception. The workers are most probable sufferers to the noise hazards of this functioning. The machineries used in Opencast and Underground workings are the main sources of noise pollution affecting the workers and their households living in the vicinity.

4) Land Degradation: Mining is the only industry in the world for which we do not have alternative sites. Indiscriminate mining in Jharkhand has been a major factor in pollution and degradation of land. Consequences of large scale mining operations are: it leads to disfigurement of natural landscapes through spoil heaps and excavations, reduction in forest and agricultural areas are some of the direct consequences of coal mining.

However, there appears to be ample scope for improvement in the surface mining system. The future of opencast mining will be determined on its ability to manage the environmental impact in a cost effective manner.

STATEMENT OF PROBLEM

Coal mining operations generate dust, gas, noise pollution at the workplace. These may cause health hazards to the mineworkers in long term if proper precautionary measures are not adopted. There are also vibrations due to blasting and heavy vehicular movement.

Air pollution due to dust generation is in terms of high level of suspended particulate matters (SPM) and Respirable Particulate Matters (RPM). This is injurious to human health and also affects biological assets in the area besides being a constant source of nuisance. Air pollution also results in serious aesthetic impacts apart from social concerns.

Dust pollution is a major problem in a mining project and the mineworkers who are directly in the operational activities in a coal mine are most susceptible to the
harmful affects of these existing conditions. The specific locations for dust formation are:

- Drilling and blasting operations
- Heavy vehicular movement
- Coal processing, loading and unloading (i.e. coal handling) & storage plants

Problem of:

- Spontaneous heating/fire in the coal reserves and associated set of environmental problems.
- Also there have been instances of inundation / flooding of underground coal mines and cases of land subsidence in the adjoining areas.
- Environmental degradation due to opencast coal mining and loss of aesthetic value.

Occupational Health Hazards

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. In private contractual mining and illegal mining which is very rampant in Jharkhand, child labour is also engaged.

The mineworkers, the people in the mining communities, and even those who are at the receiving end of toxic mine-tailings are faced with health problems. These may include skin diseases, respiratory diseases or disorders which may take a much longer duration to show its symptoms in the body which makes its detection and cure more difficult e.g. pneumoconiosis and silicosis among coal mineworkers.
General socio-economic aspects related to coal mining

Land degradation is not only caused by mining the land area but is also caused by subsequent soil erosion. Field observations also showed that during the rainy season, the topsoil was carried away by water along the steep slopes in the mine area.

Generally, coal mining operations, especially those which are undertaken by large-scale mining operations, have the following socio-economic, health, and environmental impacts:

1) Appropriation of the lands of indigenous peoples, which results in massive displacements of people.

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

3) 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. The dust coming from continuous bulldozing of the land and transport of soil and mineral ores generates air pollution.

Reclamation or rehabilitation of the land disturbed by the past surface mining operations will be costly, and in many areas the cost can be expected to exceed the benefits. A public commitment will be needed for those areas where unfavorable benefit-cost ratios are foreseen. In such cases the public will need to decide whether it wishes to spend public funds to achieve the intangible benefits of clean water, clean air, and improved aesthetic quality.

Biodiversity

Large scale degradation of land and changing of the landscape for coal mining or for that matter any other mining inevitably leads to bring adverse changes in the ecosystem and biodiversity. Frequent occurrences of mining accidents, ranging from the collapse of underground tunnels to the bursting or overflowing of mine-tailings dams, which causes pollution of lands and water bodies and affects the
local drainage pattern by choking the sub channels or main river channel and it, may lead to permanent diversion in the course of the river. This results in decrease of biodiversity, and adversely affects plants, animals and even human beings.

Choice of the Study Area

Argada Coal Mines Area - The Study Area lies in the South Karanpura Coalfield between Latitudinal extent of 23° 30' N to 23° 45' N and Longitudinal extent of 85° 15' to 85° 30' E Hazaribagh District in Jharkhand. Geographically it is in Hazaribagh Plateau, which marks the northeastern Projection of the Chotanagar Plateau. The Four coal mines in the Argada Area in South Karanpura coalfield (Namely Gidi ‘A’ OC, Gidi ‘C’ OC, Religada OC and Argada UG), which has been chosen for the Case Study, lie in the Damodar River basin in Hazaribagh.

The Damodar River runs a course of 563 kms and originates in Kharmarpet hills in the Chotanagar plateau. In its upper reaches, it passes through six districts of Jharkhand, Hazaribagh, Koderma, Giridih, Chatra, Dhanbad and Bokaro fully a 300-kk stretch in Jharkhand, thereafter, it enters West Bengal.

Damodar River twists through six coalfields - North and South Karanpura, East and West Bokaro, Ramgarh, Jharia and Raniganj. Administered primarily by three subsidiaries of the public sector Coal India Limited - Central Coalfields Limited (CCL), Bharat Coking Coal Limited (BCCL), Eastern Coalfields Limited (ECL).

Along the Damodar river lies coalfields, and other coal based industries like government owned coal washeries, coke oven plants, thermal power plants, and iron & steel plants. In West Bengal Damodar River traversing Burdwan and Hooghly districts fully, and Bankura and Purulia districts partially before joining the river Hooghly. The basin it flows through - supported by its major tributaries, Barakar (240 km long) and Konar (124 km).
Objectives

Main objectives of the proposed research are:

1) To critically evaluate the existing mining policy of India.
2) To examine the influence of mining operations on the environmental parameters of the natural environment namely, Land, Water, and Forest.
3) To examine and evaluate the environmental conservation measures taken in the study area.
4) To examine the occupational health hazards to the mineworkers and evaluation of measures introduced to ameliorate the situation.
5) To study the quality of life in the vicinity of the selected mining areas in Jharkhand.

Hypotheses

1) Coal mining operations in Jharkhand have adversely affected local natural environment as well as the surrounding areas.
2) There is general deterioration in the forest cover in the areas where mining operations are being carried out and little efforts of restoration have been attempted by mineral extracting authorities.
3) Mineworkers are prone to Health hazards at workplace.
4) The quality of life of the mineworker’s households living near the mining areas has been adversely affected.

DATA BASE

A) Secondary Data

- Topographical maps No. 73 E on the scale of 1: 250000 and & 73 E/6 on the scale of 1:50000 of Hazaribagh District (Covering the Coal mines of Argada / South Karanpura (Namely Gidi ‘A’ OC, Gidi ‘C’ OC, Religada OC and Argada UG in the Damodar River basin.
• Chronological record of the secondary data from Coal India Limited.
• Census of India and District Census handbook
• Statistical Abstract
• Reports of Ministry of Environment and Forests (MOEF), Central Pollution Control Board, New Delhi
• Coal Directory, Coal India Limited, Kolkata.

B) Primary Data

Primary data through a questionnaire based Survey conducted at the Study Area - Argada Area (CCL) of South Karanpura Coalfield Region in Hazaribagh District of Jharkhand.

Primary data was generated by administering a thorough Mineworker’s schedule to the sample population. Apart from the details related to the mineworkers socio- economic, demographic, migration pattern, there was set of perception questions asked in a systematic manner, related to mineworkers health and hazards related to the mine and Whether company has taken steps to ameliorate the situation of health hazard, if any.

The procedure of the collection of primary data has been in the following order as follows:

1) Selection of the study area and reconnaissance survey (January – February 2004).

2) Design and content of the mineworker’s schedule. (Appendix - I) 

3) Selection of the coalfield and subsequently the sample population to be surveyed.

   i) Pilot survey (April to June 2004)

   ii) Field work – Stage one (August 2004 to December 2004)

---

6 Appendix 1 - Design and content of the questionnaire.
iii) Field Work – Stage two (January – April, 2005)

iv) Field Work – Stage Three (May – August 2005)

Selection of the Sample Coalmines

It has been done on the basis of accessibility to the mine area and as well as where there is likelihood to meet variety to meet the objectives of the study.

Jharkhand was chosen for the study for certain reasons, one, the state one of the leading in India in terms of coal reserves and production, it also has had several mining mishaps in the past.

South Karanpura Coalfield was chosen as it has vast reserves of coal in the areas such as, Argada, Kuju, Bhurkunda, Rajrappa, Saunda, Sirka along the Damodar river, giving a lot of option to choose sample mines from these. Finally Argada Area was chosen which is well connected by road and is about 70 kms from the Ranchi city. The nearest railway stations are Bhurkunda, Ramgarh and Barkakana and therefore the area is well connected by road and rail links.

The study area was chosen on the basis of its Connectivity and Location (i.e. in the upper reaches of Damodar River Basin). It is quite well known that the lower reaches of the Damodar River is considered to be one the most polluted channels due to Coal Mining and associated industrial activities in the catchment area.

In the primary survey a combination of purposive stratified sampling and random sampling technique is applied. A prepared questionnaire-based survey was conducted in the chosen Argada Area in Hazaribagh district of Jharkhand. The field survey has been conducted in four mines (Three open cast and one underground). Four mines were selected in the study area. On roll workers and attendance on any chosen day generally varies in any organization. Each mine was told to have a cumulative workforce (In all three shifts combined) of 400 to 500 mineworkers including officers and supervisors. Following Mineworker’s Schedule forty five samples (questionnaire/ response) from each mine has been collected from the four categories of workers and a
cumulative number of 180 samples obtained to represent the Mining workforce engaged in the Argada Area of South Karanpura Coalfield (SKCF).

**Sample mines and sample population:**

Four operational mines in Argada Area were chosen:

1) Gidi ‘A’ (Opencast)
2) Gidi ‘C’ (Opencast)
3) Religada (Opencast)
4) Argada (Underground)

All four Categories of workers were identified to get a thorough understanding of the situation of health hazards and general health scenario and a combination of random sampling and purposive stratified sampling of various categories of worker groups was adopted for the primary survey in the mines.

Each chosen mine has a workforce of about 400 to 500 workers, including all categories and mining operation is carried out 24 hrs. In 3 shifts of 8 hrs each (i.e. 8*3=24). Normally the timings of working hours shift is as follows:

- **Shift one** - 6.00 a.m to 2.00 p.m
- **Shift two** - 2.00 p.m to 10.00 p.m
- **Shift three** - 10.00 p.m to 6.00 a.m

Shifts are rotated from time to time as per availability of the workers and as per other requirements.

1) **Officers**: This category includes Executives/Officials and Managerial staffs who directly control the overall mining operation in a hierarchical manner.

   a) **Project Officer (P.O)**: The administrative head of all the managerial, supervisory and working staff in a mine project. This position is directly responsible for the Production, and the proper functioning of the Coal Mine. The subordinate officials to the P.O at the mine in descending order of hierarchy are as follows:
b) Superintendent of Mines (SOM) / Colliery Manager

c) Senior Under Manager

d) Senior Under Manager – Special Grade

e) Under Manager

2) Monthly Rated Workers (M.R): This category, exercises control and supervision over the workers involved in the direct coal extraction procedures. e.g. drilling, blasting, loading unloading of coal, shovel operation etc Their basic wage like officers is calculated on a monthly basis that is why traditionally they are called Monthly rated workers. The workers in category in descending order of hierarchy are as follows:

a) Senior Overman

b) Overman

c) Mining Sardar

d) Shot Firer (Blasting work)

e) Pit Man / Trip Man (O.C)

3) Daily Rated Workers (D.R): This category though gets a monthly salary but the basic wage is fixed on a daily basis (except Sundays and Holidays). Hence, they are called Daily rated Workers. Few sub-categories of this working group are as follows:

a) Crane Operator (OC)

b) Shovel Operator (OC)

c) Dozer Operator (OC)

d) Dumper Operator (OC)

e) Drill Operator (OC)

f) Grader Operator (OC)

g) Pump Operator (UG)
h) Fan Operator (UG)
I) Trammer (UG)
J) Lamp Incharge (UG)
K) Electrician (Engineering & Mining)
L) Mechanical Fitter (E & M)
M) Mechanic (E & M)

4) **Piece Rated Workers (P.R):** This category of workers is the lowest among the mineworkers in order of hierarchy. Usually allocated work in underground mines but not strictly. They are also employed in manual labour work wherever it is required. They have to fill fixed number of tubs (one tonne capacity each) with blasted/extracted coal. They are paid on a pro-rata basis i.e. if they fill less quantity then they will be paid less and if they fill more then they will be paid more on pro-rata basis. That is why this category of workers is called piece rated because their salary is on the basis of piece of work done in a day.

**Table 1.1**

<table>
<thead>
<tr>
<th>Worker’s Category</th>
<th>Gidi A (OC)</th>
<th>Gidi C (OC)</th>
<th>Religada (OC)</th>
<th>Argada (UG)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officers</td>
<td>07</td>
<td>07</td>
<td>07</td>
<td>03</td>
<td>24</td>
</tr>
<tr>
<td>Monthly Rated</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>06</td>
<td>51</td>
</tr>
<tr>
<td>Daily Rated</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Piece rated</td>
<td>03</td>
<td>03</td>
<td>03</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>180</td>
</tr>
</tbody>
</table>
Methodology

A) The Socio- Economic data about mineworkers generated through field survey questionnaire has been analyzed in Chapter IV By taking simple Percentages of the data and wherever found necessary primary data along with data obtained from secondary sources has been used for analysis.

B) The field data related to Health and mine Environment has been subjected to Chi Square ($X^2$) test. The chi Square analysis is carried out using the following formula:

$$ (X^2) = \sum_{i=1}^{n} \frac{[ (O_i - E_i)^2 ]}{E_i} $$

Where,

$X^2 = \text{Chi – Square}$

$O_i = \text{Observed Frequency of the ith class}$

$E_i = \text{Estimated frequency of the ith class}$

The shape of the distribution will vary with $(n-1)$ which is known as its degrees of freedom. (Kendall)$^7$

Degree of Freedom: $df = (r-1) (c-1)$

Where,

$r = \text{the number of rows and}$

$c = \text{the number of columns, of the tabulated data.}$

In the present study, $r=2$ and $c=2$ therefore,

$$ (df) = (2-1) (2-1) = 1 \times 1 = 1 $$

c) $X^2$ can also be calculated for df = 1 by the following formula:

$$X^2 = \frac{(ad - bc)^2 N}{(a+b)(c+d)(a+c)(b+d)}$$

Where,

$X^2$ = Chi Square

$N$ = Sum of values is matrix (a+b+c+d)

a, b, c, d are the values in the matrix as

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>d</td>
</tr>
</tbody>
</table>

**Topographical Sheets and Maps:** Base maps of the study area on 1:50000 scale of the topographical sheet no's 73E and 73 E/6 from Survey of India and several maps for South Karanpura Coalfields (SKCF); have been prepared with assistance from the geology department, CCL HQ Ranchi. These maps have been georeferenced in GIS environment and further used to prepare other maps. Geo-referencing and onscreen digitization of the maps have been done in GIS softwares such as Erdas Imagine 8.7 and ArcGIS, ArcView GIS VERSION 3.2 a and Arc Map.

**Problems and limitations:**

1) The number of workers in various categories usually doesn’t remain consistent due to work area shifting, sick leave, workers assigned jobs as helpers to the officers etc.

2) Despite several efforts there was reluctance on the part of project officer’s office to part with the workforce data of the mines and it was told that it could be accessed only from the CCL HQ, Ranchi, whereas there at CCL HQ it was told that the current data could be obtained only from the project officer’s office. Finally at the mine sites I could get the figures at site itself, which appeared to be rounded off by the managerial staff at the quarries.
3) Gidi A-500, Gidi C- 400, Religada-500, Argada (UG)-350 which amounts to 1750. It was decided to obtain a sample population of 10% miners' from the overall Argada area including all categories proportionately. There was reluctance on the part of many officials and workers to give an interview or even workers as it was perceived by them that their responses may put them into some trouble with the management or authorities. Despite several clarifications given, it was observed that many of them strongly believed that this survey was a government sponsored enquiry.

The following adjustments have been made in the data, which has been subjected to chi – Square analysis:

There has been consistency in the perceptions of Officers and Monthly Rated Workers, as Monthly rated workers are not engaged in direct extraction procedure from the quarries and they control and supervise the daily rated and piece rated workers. Therefore these two categories have been merged into one for X² analysis.

Similarly, Daily Rated workers and Piece Rated workers have a consistency in their responses and there is in fact very thin division in their type of work as they are semi – skilled and directly involved in extraction and transportation of coal, which require labour. Therefore these two categories have merged into one for X² analysis.

Introduction to the study area:

South Karanpura Coalfield (SKCF) lies between the latitude 23°38' North to 23°45' North and Longitude 85°05' East to 85°28' East. The semi elliptical shape SKCF covering an area of 180 sq km falls in Hazaribagh district of Jharkhand. The coal mining activities area confined in 100 sq km in the eastern and central part of the coalfield. The chosen mines of the study area namely, Gidi A, Gidi C, and Religada (OC) lie in the northeastern part of SKCF and Argada (UG) lies in the far eastern part of SKCF. This coalfield is located in the western part of the Damodar valley with an east west elongation of 32 km and a north south width
LOCATION OF SOUTH KARANPURA COALFIELD IN JHARKHAND: INDIA

INDIA (2001)

Fig. 1.1
of 8 km. The Aswa pahar in the North west separates it from North Karanpura Coal field (NKCF) by an elongated, narrow metamorphic ridge. However a narrow tongue of Talchirs in the western extremities of SKCF connects it with NKCF.

**Drainage and Topography**

The general slope of this coalfield is towards the Damodar river which flows through the central part of the coalfield from west to east. The other tributaries of Damodar are Nakari nalla, Potanga nalla, Tilaiya nalla etc. The altitude within the central coalfield varies from 419m to 341m above Mean Sea level.

**Communication**

The coalfield is well connected by roads and railways. The Gomo-Barkakana-Daltonganj-Chainpur loop line of the Eastern Railways passes along the southern boundary of the coalfield and Barkakana-Bhurkunda-Argada Road and Naisarai to Gidi metalled road connects this coalfield.

The Coal trunk Road (CTR) construction is in progress which will connect SKCF with NKCF. Ranchi is also connected to this coalfield through NH-33 (Ranchi-Ramgarh-Hazaribagh) and Patratu-Ranchi road also. The Patratu Power Station (PTPS) is located near the southern fringe of the coalfield.

The Gidi washery is located within the coalfield near Gidi A colliery. The Bihar alloy Steel industry is located only 2km from the PTPS. The Indo Asahi Glass factory is located near the Bhurkunda Railway Station.

**Regional Geology**

SKCF as we know today is an elongated stretch of East – West trending lower Gondwana sediments. The Central portion of the coalfield comprising of areas like Sayal, Saunda, karanpura and Gidi occupy three times the area covered by Barakars towards East or west. This formation attains maximum thickness of 1053 m in the SKCF and play host to all the important coal seams of the area.
SOUTH KARANPUR COALFIELD

CONNECTIVITY IN THE ARGADA AREA

Fig. 1.2
The strata in the eastern part of South Karanpura sub basin represents a huge fold of which the Southern limb is faulted by the main boundary fault and the preserved northern limb with its west ward extension forms the present coalfield. The eastern and northern peripheries of the coalfield generally witnesses gradational contact with the metamorphic basement.

However in the northern, Southern and western part of the Coalfield the boundary is faulted and young formations are in direct contacts with the metamorphics.

The Coalfield forms a narrow east-west trending elongated sub-basin with pre-Cambrian metamorphic Bundu-Tangi inliers close to the eastern limits. The lithological succession constitutes mainly the lower Gondwana group of rocks.

The following sequence of geological succession and rock formation is given in the following table. (CCL, Geo Mining Database, 2003)⁸

---

⁸ Central Coalfields Limited (CCL): Report on Geo Mining Database of South Karanpura Coalfield Limited, Funded by Coal India Limited (CIL) Research and Development Board, 2003, pp-10-12
Table 1.2

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Lithology (With thickness in m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dolerite &amp; Mica–Peridotite intrusives</td>
</tr>
<tr>
<td>UP Permian</td>
<td>Raniganj</td>
<td>Fine grained sandstone, micaceous sandy shale and carbonaceous shale (610 m)</td>
</tr>
<tr>
<td>Mid Permian</td>
<td>Barren</td>
<td>Medium grained sandstone, Ironstone measure shales and micaceous shales (300 to 450 m)</td>
</tr>
<tr>
<td></td>
<td>Barakar</td>
<td>Coarse-grained sandstone, sandy shale, Carbonaceous shales and coal seams.</td>
</tr>
<tr>
<td>(1050 m) Lower Permian</td>
<td>Karharbari</td>
<td>Coarse grained pebbly sandstone, shales and coal seams (75 m)</td>
</tr>
<tr>
<td>UP Carboniferous to lower Permian</td>
<td>Talchir</td>
<td>Conglomerates, fine to medium grained sandstone and green shales (3 to 16m)</td>
</tr>
<tr>
<td>Precambrian</td>
<td>Unconformity</td>
<td>Granite, granite gneiss, mica-Schist, quartzite and limestone.</td>
</tr>
</tbody>
</table>

Source: Department of Geological Services, CCL, Ranchi

The metamorphics forms the floor of the basin in which the sediments of the lower Gondwana were deposited. The rocks comprise mainly of granite, granite gneisses, mica schist, quartzite and limestone. The limestone is found in some areas in patches. These rocks are exposed all along the periphery of the coalfield. A huge mass of metamorphic in the form of inlier can be seen North of Maurya and Southeast of Gidi, called the Basaria-Bundu–Tongi inlier depicting the
uneven basement. Metamorphic highs corroborating the fact of uneven basement are evident in the floor of Naditoli and Karharbari seams.

Talchir rocks overly the basement conformably. They are greenish shales or tillites. The Talchir Tillites consists of angular to sub-angular pebbles of quartz, quartzite or granite. These rocks are exposed in small patches generally along the boundaries. Talchir outcrops can be seen along the northern and eastern boundary of Argada block. Further ahead Talchir outcrops are present along the north eastern and northern boundary of Asnagara block. In the western part of the coalfield huge exposure of Talchir exists between Hendegir block and Hendegir Railway Station in Chenugara area.

Karharbari formation strata uncomfortably overlie the Talchir formation. These rocks are generally coarse to pebbly sandstones in greenish and grayish fine matrix. The Karharbari outcrops are present in Argada to Maurya blocks in the eastern part of the coalfield and in Gidi ‘C’ block towards northeast. The Argada ‘S’ seam in this formation typically have low ash contents with variable thickness. The other seams have high ash with lesser thickness.

Barakars find their place above karharbari in stratigraphic hierarchy. In most part of the coalfield the barakars directly overlie metamorphics. Only in the eastern and north-eastern part barakars conformably overlie the karharbari. This is the main coal bearing formation of the area. The lithological variations are from course to fine grained sandstone to shale, carbonaceous shale to inter calculations of shale and sandstone. There are about thirty-eight coal horizons in the entire sequence. The upper part of the barakars has comparatively more finer facies than the lower. The outcrops of the sequence can be seen along the nala and road cutting and good sections are observed along the banks of river Damodar. Barakars gradually thin towards west and especially towards Urimari and Aswa blocks where Sirka seam pinches out and parting between Bansgarha and Argada is greatly reduced as compared to the central and eastern part of the coalfield. Pinching out of Kurse, Nakari and Lower Semana in Hendegir block further goes to prove the reduction in thickness of Barakars is in central portion
of the coalfield and this has developed due to presence of series of faults dipping opposite to the dip of the strata.

Barren measures are exposed in the central part of the coalfield and overlie the barakars conformably. There is a gradational contact between barakars and barren measures. The contact is conventionally assumed at fifty meters above the youngest coal seam. The formation is devoid of any workable coal seams. The other lithological entities in barren are some as barakars, expecting the presence of Iron Shale, which is characteristic of barren measures. Within the exploration blocks barren measures are exposed in the southern side of Saunda ‘D’ , Urimari , Aswa South and Tokisud blocks whereas it cover the entire South Sayal block.

Raniganj rocks occupy the south – central part of the coalfield conformably overlying the barren measures. It forms an elongated elliptical outcrop from Patratu towards east to Binja towards west. The formation has dominant finer facies. The major litho-units are fine grained micacious shale and carbonaceous shale. There are occasional thin layer of very coarse grained sandstones found in the lower sequence of Raniganj formation.

Igneous intrusives are located in the central and western part of the coalfield. They are in the form of mica peridotite sills and dolerite dykes. The effect of dykes on coal seams is limited to few meters on either sides while major burning is observed in case of sills which destroy coal seams partially or completely in a area. Burning of coals by mica peridotite sills is seen in the central part of Central Saunda, Sayal ‘D’ and Sayal ‘A’ blocks where generally Lower Sirka, Argada ‘A’ seams are affected. In the western part the sill has partially baked saunda and Balkudra in South Urimari and Partially or fully affected Argada seam in North Urimari area. Dolerite dykes exposures are generally seen in Damodar River sections near Gidi ‘A’, Sayal ‘A’ and Urimari areas. Dolerite dykes are intersected in borehole of Hendegir block but are not exposed at the surface.
Mining Activities in SKCF

South Karanpura Coalfield comes under Central Coalfields Limited (CCL), with its headquarters at Ranchi. Consultations with Geology department, CCL revealed certain information about the SKCF area which is summarized below. Mining is mainly confined to the central and eastern part of the coalfield. Opencast quarries are generally concentrated in the central part of the coalfield and the underground workings are also located in the Southern portion of this area. The central part with exception of sirka block may be termed as the main mining hub of the coalfield.

Mining has been done in a haphazard manner to recover the good quality coal from this coalfield and there was no systematic planned approach for mining the coalfield. This has resulted in blocking of huge coal reserves under surface structures, area under fire, water logged workings etc. In the present study an attempt has been made to integrate the entire mines/ blocks so that a complete overview of the coalfield can be taken up.

Mining area can be divided into following zones based on geological and geographical considerations. SKCF can be divided into two geographical entities:

I. North of Damodar river, and

II. South of the Damodar river

I. North of Damodar River

i) Argada-Maurya-Sirka zone

ii) Gidi zone (Gidi –A, Gidi C, Asnagarha block)

iii) Urimari-Aswa zone (Urimari North, Urimari South, Aswa North and Aswa South)

iv) Tokisud-Hendegir zone
II. South of Damodar River

v) Chordhara-Lapanga Extn-Bhurkunda Zone (Chordhara/Lapanga, Lapanga Extn. Bhurkunda Extn.)

vi) Saunda-Sayal zone (Saunda- D, Central Saunda, CCL Saunda, Associated Karanpura, Khas Karanpura, Sayal-D, South Sayal and Sayal – A blocks)

The study area of the present study lies north of Damodar River. Out of the above six zones extensive mining have taken place in Gidi zone. Tokisud is a non CIL block and can be allocated as a captive mining block to producers of steel, fertilizer, cement and power etc. In Hendegir block mining activities has been closed by CCL and there is no further programme of planned production from this block.

In Chordhara- Lapanga Extn in Bhurkunda zone extensive mining activity has taken place especially in Chordhara block. Bhurkunda and Bhurkunda South West have been extensively worked out.

In Saunda- Sayal zone all the blocks have been extensively worked out by both opencast and underground mining. In this zone coal has been blocked due to fire, water, surface structure etc. Zones falling north of Damodar except Hendegir are most potential zones for further mining.