

Susceptible Development: Impact of Coal Mining on Environment in India

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Received: 8 December 2012 Accepted: 31 December 2012 Published: 15 January 2013

Abstract

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

Index terms— pollution, coal mining, development, displacement, global warming

1 Introduction

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

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

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

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

62 2 II.

63 3 Objectives of the Study

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

73 4 III. Sources of Data & Methodology

74 The An action plan for minimizing the adverse environmental impact from the proposed mining activity should
75 be prepared. This shall also include rehabilitation of the mining area. The important aspects to be considered
76 are:a) Pre-Operational Phase c) Post-Operational Phase

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

79 5 VIII.

80 Drilling and Blasting (Noise Pollution)

81 6 a) Noise Pollution In Raniganj And Jharia Coal Mines

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

88 7 b) Noise Pollution Due To Mining Activities

89 The most note generating equipment underground are the haulage, ventilators-main, auxiliary and forcing fans,
90 conveyor transfer points, cutting and drilling machines. The ambient noise level due to different operations in
91 underground mines varies within 80-1040 dB(A). In a mine of Raniganj and Jharia the noise level near fan house,
92 conveyor system shearer and road headers was reported to be within 92-93 dB (A). The values increased in many
93 Indian mines because of poor maintenance of the machines and exceeded the permissible limit of 90 dB (A) for
94 8 hours per day exposure. The result of a noise survey for a coal mine conducted by DGMS (Director general of
95 mines safety) is summarized in the following table which indicates noise over 90 dB by the drills, breaking and

96 crushing units and transport system underground. (i) Vegetation barriers should be raised along the contours in
97 the hilly areas for the prevention of soil erosion and for arresting the mine wash.

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

100 (iii) The banks of streams in the mining area should be intensively vegetated to prevent the discharge of
101 sediments into the streams. b) Operational Phase (i) For opencast mines, screens or banks of soil and overburden
102 shall be constructed in the peripheral area.

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

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

108 8 Global Journal of Human Social Science

109 Volume XIII Issue VIII Version I Year 20132 20 226

110 ()B

111 (v) relevant terrain information that will help in waste dumping, tailings disposal, etc., with least effects on
112 the local land-water system, including-(a) geo-morphological analysis (topography and drainage pattern), (b)
113 Geological analysis (structural features-faults, joints, fractures, etc.), (c) Hydro-geological analysis (disposition
114 of permeable formations, surface-ground water links, hydraulic parameters, etc.), (d) analysis of the natural
115 soil and water to assess pollutant absorption capacity, and (e) availability and distribution of top-soil; (vi)
116 communication and transport facilities; (vii) details concerning the mining plans-(a) minerals to be worked, (b)
117 method of working, (c) details of fixed plants, (d) nature and quantity of wastes and disposal facilities required
118 for them, (e) possibilities of subsidence and landslides, (f) transport facilities needed, and (g) Services to be
119 installed. cutting machines. The results (Table 3) covering wholly manual, partly mechanized with coal cutting
120 machines and partly mechanized with SDL loading showed reduction in the noise level underground. The blasting
121 underground cause's high frequency sub audible noise measured in terms of air over pressure. The magnitude of
122 air pressure is found to be 164 dB (1) at 30m distance reduced to 144 dB (1) at a distance of 70m. Test results of
123 some of the sites are summarized in the following table. The total noise menace due to blasting underground is
124 the result of the audible and sub audible noise. The sub audible noise responsible for vibration causes vibration
125 of the surface features and in case of thin overburden cracks in surface structures. This societal reaction of Jharia
126 Town Development Forum over blasting forced the pick mining in some of the situations. The reaction of blasting
127 is reported in the following forms.

128 ? Damage of old structures due to vibrations.

129 ? Public nuisance vis-à-vis disturbance of sleep.

130 ? Disturbance of sewerage and water supply line.

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

136 The noise control measures in general are categorized in three groups: personal protective measures, engineering
137 control measures and The preferred cost effective system for the underground mining has been the personal
138 protective system -ear muffs for the operator of the noise producing units.

139 IX.

140 9 Toxic Waste Treatment

141 Nearly 25-35% of rain water drained back to ocean through rivers and streams; the major source of potable
142 water for local population. Except particulate impurities (coal dust/soil/clay) and bacteriological or biological
143 impurities; the river water was normally fit for consumption. Normal filtering and disinfectants made the water
144 acceptable and had been used in India and elsewhere. Ground water on the other hand was not fit for consumption
145 unless treated for hardness. The quality of mine water of Jharia and Raniganj Coalfield obtained from the
146 underground mines are summarized in the following table. Note: All parameters are in mg/l unless specified
147 otherwise NA stands for not analyzed.

148 ? Acid mine drainage in case of high sulfur coal ? Eutrophication and Deoxygenating due to growth of algae
149 because of sulfur.

150 10 ? Heavy metal pollution

151 High level of dissolved solids such as bicarbonates, chlorides and sulfates of sodium calcium, magnesium, iron
152 and manganese are introduced to water while passing through aquifer and aquiclude made permeable due to
153 sagging and industrial usage without treatment. This makes the water hard, unfit for drinking, other impurities
154 in a few selected mines of Jharia and Raniganj coalfield. Low level nitrates and phosphates served as nutrients

12 A) HEAVY METAL POLLUTION

155 to algae; rapid growth of which caused deoxygenating of water, and lowering of dissolved oxygen. This was likely
156 to occur when the underground water was accumulated in water pools. Use of such water for irrigation might
157 improve production and yield of crop.

158 11 a) Acid Mine Drainage

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

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

175 12 a) Heavy Metal Pollution

176 Heavy metals like lead, zinc, arsenic and cadmium were detected in traces in the mine water, mainly because
177 of leaching of aquifuge, aquiclude and igneous intrusions and effluent of oil and grease from the machines
178 underground. The toxic substances generally in the confined state within the rock mass were exposed to dynamic
179 setting of soil water system when they start polluting mine water. The list of the toxic elements and their impact
180 is summarized as follows: The presence of a large number of trace elements in coal was attributed to species
181 of carbonaceous swamps or contemporaneous sedimentation with holmic acids solubilizing and binding these
182 elements. Trace elements might have come through inflowing these element might have come through inflowing
183 ground water during calcification. The magma tic and fluid might have resulted epigenetic elements like. As,
184 Cd, Hg, Pb and Zn were the inorganic fraction of coal while Cr, Cu and Sb were present in mineral and organic
185 from. The concentration of trace elements in Raniganj and Jharia coalfield is summarized below.

186 In the process of mining these elements were released or mixed to the inflowing water and ultimately to water
187 channel. Settlement of the ground with water drainage induced additional cracks and fissures over the surface.
188 As a result, the rate of precipitation increased when higher percentage of rain and surface water infiltrated down
189 ward; raising overall water table. Furthermore, in place of a few confined aquifers, extensive unconfined/ leaky
190 aquifers were formed with the ground movement.

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

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

208 The ground movement impact on hydrosphere was manifested in the form of increased storage and charging
209 character, lowering and disturbance of the water table, loss of streams or water pools. Some of them improved
210 the water availability to the flora and fauna and biomass in general and improved the environment and ecology
211 while a few caused temporary damage to the environment and ecology with the development of the fracture
212 planes and opening of the cracks. The positive impact of the ground movement over the hydraulic regime was
213 however, diluted due to repeated mining of the seams one after the other. With each seam working, the cycle of

214 negative impact was repeated, water table lowered and level of pollution increased time and again. It takes time
215 -a couple of years again before the regime were restored to normalcy.

216 **13 c) Illegal Coal Mining**

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

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

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

237 **14 X.**

238 **15 Some Negative Impacts of Illegal**

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

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

249 XI.

250 **16 Illegal Coal Business in Raniganj And Jharia Coalfield**

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

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

259 The quantity of coal per truck is 20 tons and the price of this amount of coal is Rs. 60,000 per truck. In
260 this way the business of illegal coal is approximate more than Rs.3 billion per day. In this coal mining region
261 the illegal coal business continues up to 9 months in a year. During these 9 months approximate 1.35 million
262 truck coal is extracted from illegal mines. The total amount of coal business continues up to Rs .8 billion in a
263 year. Per day illegal coal production-500 truck (per truck 20 tons) Coal production in 9 months- $500 \times 270 =$ The
264 state cabinet while approving the Mineral Dealers' Rules-2007 strongly felt that the there are a large number of
265 dealers operating without any proper record or registration with the mines and minerals department.

266 Hence the government decided to make the registration of operating dealers mandatory with the department
267 concerned. This will put a spanner on illegal marketing and smuggling of major minerals like iron ore, bauxite
268 etc, said the secretary, mines, Jaishankar Tiwary. The state government he said is unable to cross check the
269 minerals stocked or stored at any place.

270 Those dealing in minerals had the plea that they paid off the royalty at the mining site and have stored the
271 stock at some other place for transportation. The government also felt the need of cross checking and verification

272 of minerals, as there is no provision available under the Central Government Mines and Minerals Development
273 Act (MMDR), 1957.

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

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

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

285 17 XII.

286 18 Concluding Observations

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

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

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

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²20 2 25 (i) present land use pattern of the area; (ii) main features of the human settlements in the area; (iii) characteristics of the local eco-system; (iv) climate of the area; Susceptible Development: Impact of Coal Mining on Environment in India

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Figure 1:

1

c) Study Area

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

IV. A Brief Description of Raniganj and Jharia Coal Field

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

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

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

Figure 2: Table 1 :

3

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

[Note: © 2013 Global Journals Inc. (US)]

Figure 3: Table 3 :

4

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

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

Figure 4: Table 4 :

5

Figure 5: Table 5 :

6

Year	Area	Kunustoria						
2013								
2 20 2 28	Project	Parasea UGP						
Volume	Qtrending	Samplining	station	June 2009	W1 Mine	Effluent	wa-	
XIII	Date of sample	Colour	Orour	discharge	from pit	ter(MOEF		
Issue	TSS PH	Temperature	o c	Oil &	no. 2 9 th	May 2009	schedule-vi	
VIII	grease	Total residual	chlorine	unobjectionable	un-	standard)		
Version				objectionable	44.00	unobjectionable		
I				8.40	Normal	<1.00	unobjectionable	
						100.00	5.50-9.00	
						Shall not exceed	5 0	
						C 10.00		
()	Ammonical Nitrogen	Total kjel-	Nil	0.03			1.00 50.00	
	dahi nitrogen							
Global	Free ammonia	B.O.D.	C.O.D.	0.76	BDL	-40.00	100.00	5.00 30.00
Journal	Arsenic Lead	H .Chromium	To-	<0.01	<0.05	0.08	250.00	0.20 0.10 0.10
of	total Chromium	Copper	Zinc Se-	0.08	0.05	0.02	<0.01	2.00 3.00 5.00 0.05
Human	lenium Nickel	Fluoride		-			3.00	
Social								
Science								
	Dissolved phosphate			0.46			2.00	
	Sulphide			-			5.00	
	Phenolics			0.04			2.00	
	Maganease			<0.001			1.00	
	Iron			0.22			2.00	
	Nitrate nitrogen			0.18			3.00	

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

Figure 6: Table 6 :

7

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

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

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

Figure 7: Table 7 :

8

[Note: *Results in ppm.]

Figure 8: Table 8 :

9

Element	Concentration ($\mu\text{g} / \text{g}^{-1}$) of Trace Elements in Regions Kunustoria
Antimony	1.35
Arsenic	14.9
Cadmium	2.89
Chromium	14.1
Fluorine	59.3
Lead	39.8
Mercury	0.21
Barium	113.8
Nickel	22.4

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

b) Water Regime Disturbance

Disturbance of lithosphere, yield and movement of ground water, dewatering of the workings and recharging of overburden formation were the interrelated operation of underground mining. Dewatering from underground, recharging from rainwater precipitation

Figure 9: Table 9 :

1.35 million Per annum business of illegal coal-1.35 million truck \times truck In market value of per truck coal-Rs.60, 000 60,000=8.10 billion Fixed amount from 1 truck coal: Value of coal-20,000 Rs. Police-10,000 Rs. Terrorists-5,000-6.000 Rs. Fare of truck-15,000-20,000 Rs. Amount of the coal marchent-5,000-10,000 Rs. Many local people also engaged in this illegal coal business. a) The Region Of Illegal Mining Jharia region-Mohuda, Bhatdih, Murlidih, Gobindpur, Tetulia, Katras, Kusunda, Kustaur, Lodhna, Mourigram, Sudamdih etc. b) Laws To Curb Illegal Mining In order to curb illegal mining and rampant smuggling of major minerals, the state government has formulated Jharkhand Minerals Dealers' Rules (JMDR-2007) to check the menace.

Figure 10:

312 The water pollution problem in the mining areas is broadly classified into the following major heads depending
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