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IMPORTANCE OF EIA IN RELATION TO RAT HOLE COAL MINES OF MEGHALAYA

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INTRODUCTION

The constitution of India was one of the first in the world to recognize the importance of environmental conservation, preservation and protection. According to Section 2(a) of the Environmental Protection Act (1986), environment includes – water, air and land and the inter-relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro-organisms and property. However, widespread deforestation, over-population, industrial and agricultural development have jeopardized the very existence of the planet, and the doubly wise homo sapiens, the pillagers of environment, excel in this act and has put his very own existence at stake. Environmental degradation and the destruction of tropical forest is at a faster rate than assumed, and the rich diversity of species is lost forever.

It is because of growing concern about the deterioration of the environment that many countries have formulated Environmental Protection Laws. These laws require that the project proponent should prepare a detailed Environmental Policy Act became law in 1970. Since then, EIA has come out and established itself all over the world as a very important planning and decision-making tool. Environmental Impact Assessment is a formal study process used to predict the environmental consequences of a development project with an idea of selecting the optimal alternative, which results in beneficial effects and thereby mitigates the adverse impact on the environment. The development projects may include viz. buildings, hydro-electric installations, factories, irrigation projects, industry, harbours and airports etc. Above all, the aim of EIA is to ensure that potential problems are foreseen and rectified at the initial stage of project planning and design.
After the United Nations Conference on the Human Environment in 1972 at Stockholm, Sweden, a significant importance to environmental conservation was given by the Government of India by formulating Acts. Consequently,

(i) Wildlife Protection Act, 1972.
(ii) Water (Prevention and Control of Pollution) Act, 1974.
(iii) Forest Conservation Act, 1980
(iv) Air ((Prevention and Control of Pollution) Act, 1981.
(v) Environmental Protection Act, 1986
(vi) Public Liability Insurance Act, 1991.

came into force. In addition, a notification of environment was enacted in May, 1994, under the Environmental Protection Act, 1986.

The objective of this paper is to highlight the importance of EIA in the rat-hole coal mines of the states, and how sustainable development can be realized by using EIA as a valuable tool in eliminating undesirable effects on natural systems and the environment
that arise from contemplated actions. The paper will cover, among other things, the following: viz. location, socio-political structure, description of coal-mining activity, environmental consequences, environmental impact assessment process, environmental impacts of rat-hole coal-mining operations, mitigation, relevance of EIA in the existing scenario and conclusions.

2. LOCATION

Meghalaya is a small hilly state tucked in the North-Eastern part of India bordering Bangladesh on the south and the State of Assam to the north. It lies between latitude 250N and 260N and longitude 90oE. The state covers an area of 22,429 sq. km. and is rich in mineral resources such as limestone, coal, uranium, clay, copper, iron-ore, quartzite, etc. Coal and limestone are found in abundance. Coal extraction is as old as our civilization and it has become an essential mineral for our survival. The coal of Meghalaya is of Gondwana origin and is found in abundance in the four districts of Jaintia hills, Garo East Khasi hills, West Khasi hills and Baghmara. An estimated coal reverse of over 500 million tones exists and the annual extraction rate as per 1988-89 is about 17.0 million tonnes.

3. DESCRIPTION OF COAL-MINING

In Meghalaya the coal is mostly extracted by underground mining. Underground mining in the state differs from other forms of coal-mining and uses a peculiar tribal method – which is popularly known as "rat-hole" mining. In this type of mining, a hole is made and the extraction starts and it goes deeper and deeper – the hole may be of the size of a man who could barely go and come out lying down. Depending upon the availability of coal, the extraction hole, or burrow, may sometimes go up to a distance of several kilometers. In addition, the ramification of the burrow into different directions is also done for the maximum extraction of coal. As the burrow becomes deep, a hand cart is used for the speedy movement and transportation of coal. The coal so dug is stored on the nearby road for easy loading onto the truck and transportation outside. Hundreds of truck loads of coal per day are exported to nearby Bangladesh.

4. SOCIO-POLITICAL STRUCTURE

The state of Megahalaya came into existence in 1972. Khasi, Jaintia and Garo from the three main ethnic groups of the state. These groups are recognized as scheduled tribes by the government under the Constitution of India. The state has a matrilineal society – the women enjoying equal rights and freedom as the male members. In addition, the state falls under the Sixth Schedule of the Constitution of India, enjoying special privileges and rights. There is a village head (Gaonbuda) in each and every village, who looks after the welfare and other relevant matters of the village. At the district level, there is a district council which enjoys a fair amount of autonomy in its functioning. The district council is an elected body headed by a Chief Executive. Meghalaya is one of the few states in India where more than 95% of forest is owned by private individuals.

The main source of livelihood of the majority of the population is agriculture. The primitive method of agriculture by shifting (swindle) cultivation is widely practiced in the region. Jhumming is considered to be destructive and uneconomical. Jhumming involves the burning of forest tree cover, and after the fire reduces everything to ashes the remainder of the logs are carried and used by the cultivators as fuel wood. The burnt forest is left till the start of the monsoon season, after which cultivation starts. This Jhumming process primarily destroys the forests and the rich biodiversity of the forest is lost foreover. Burning of forests for shifting cultivation results in degradation of soil, loss of soil fertility and soil erosion, leading to floods and siltation in rivers, dams, etc. It is estimated that about 40 tonnes of top soil per hectare of land is washed off annually. Nevertheless, half a million tribal families are involved in Jhumming and approximately 280,000 hectares of land is under shifting cultivation. But the ever-increasing population has put extra pressure on the land and the shifting cultivation (jhumming) cycle has been reduced from the earlier 30 years to five years or even shorter.

5. ENVIRONMENTAL CONSEQUENCES

The recovery rate of coal in underground mining from the rat-hole method is small compared to that of open-cast mining, which stands at 85%.

Due to peculiar land tenure systems prevalent in the state, most of the mines are owned by private individuals. Some thousands of rat-hole coal mines are in existence all over the state, which is already proving a great danger to the environment. Of the various adverse environmental impacts of mining, degradation of land is significant. In mine areas, eco-systems are drastically changed and striking change when mining progresses is the destruction of trees and other vegetation leaving behind scars of exposed soil which are washed away during the rains. In addition, the roads which are made for transport of materials bring about destruction in much larger areas than the mine area.

In addition, contributing mud and slush to the streams, which carry them down and make soil infertile, the presence of organic sulphur in the coal raises the acidity of the natural waters. The introduction of mine waters into the natural drainage is likely to affect the quality of surface water rendering it unsuitable for many purposes. The polluted water in mine sumps and any other impundments can cause percolation into the ground and may impair the condition of ground water. Apart from water pollution, mining contributes dust to the atmosphere, covering the foliage successfully, and destroys the plants. Even during loading and unloading, coal dusts are spreading to nearby areas and are constantly being inhaled by workers. Moreover, the local inhabitants too, who are continuously exposed to mining dust, suffer from respiratory and ophthalmic illnesses.

Subsidence of land is quite apparent in the coal-mining areas and this has become one of the major problems in the state.

6. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS OF RAT-HOLE COAL MINES.

The primitive tribal method of rat-hole coal-mining is considered to be very destructive to the environment. In addition, the peculiar land –tenure systems prevalent in the state makes the study of Environmental Impact Assessment even more necessary.

Environmental Impact Assessment involves the following tasks

1. Identification of alternatives and comparing their environmental impacts which is a key aspect of undertaking EIA.
2. Scoping involves the identification and narrowing down of potential environmental impacts both beneficial and adverse, so that the environmental assessment focuses only on those that are likely to be significant..
3. Description of proposed coal-mine and base line data in EIA including the purpose, characteristics, land requirements and wastes expected to be generated and the data on flora, fauna, soil geology, water, air and landscape/land use.
4. Prediction of impacts – the potential magnitude (size and nature) of the environmental impacts must be predicted. Prediction should characterize the impact's causes and effects, and its secondary and synergistic consequences for the environment and the local community. Prediction follows an impact, within a single environmental parameter (e.g. toxic liquid effluent), into its subsequent effects in many disciplines (e.g. reduced water quality, adverse impacts on fishes, economic effects on fishing villages and resulting socio-cultural changes). Prediction drawn on physical, biological , socio-economic and anthropological data and techniques.
5. Evaluation helps in evaluating the predicted adverse impacts to determine whether they are significant enough to warrant mitigation.
6. Mitigation measures need to be identified when certain impacts are likely to be environmentally unacceptable, so as to reduce these impacts to within accepted levels. These measures may include:

    (i) the changing of project sites, routes, processes, raw materials or design;
    (ii) the introduction of pollution controls, waste treatment, environmental parameter monitoring (e.g. air and water quality);
    (iii) the restoration of damaged resources, or money to the affected persons.

7. The last step in environmental assessment in the presentation of results in such a way that decision-makers can be informed of what needs to be done.
8. Public participation/consultation should form an important part of the EIA process. Involvement of NGOs, voluntary agencies, etc. should be encouraged.
9. Monitoring the impacts of the rat-hole mines so that any environmental impacts are kept to a minimum. Monitoring would ensure that the impacts are kept within the prescribed limit. Further, it helps in identifying previously unidentified impacts and makes provisions for their mitigation.

7. **ENVIRONMENTAL IMPACTS OF RAT-HOLE COAL MINING OPERATIONS**

Rat-hole coal mines, which may number in thousands in various parts of the state, affect large areas of land generating environmental impacts. The most significant impacts are as follows:

(a) socio-economic and land-use impacts;
(b) water quality impacts;
(c) air quality impacts;
(d) ecological impacts.

Rat-hole coal mines generate a number of environmental impacts and issues such as land use/landscape, hydrology, air quality, surface and ground water quality, ecology, health-safety and socio-economic impacts, must be considered at the time of EIA preparation.

7.1 Identification of Impacts

Rat-hole coal mining in totality can result in major impact on existing land use by deforesting the surrounding area and the creation of over-burden dump, void and civil structures etc.

7.1.1 Socio-Economic Impacts

- Changes in migration to and from the area. Large numbers of labourers are mostly from neighboring countries of Nepal and Bangladesh.
- Significant changes in employment and infrastructure.

Hazards of working in such coal mines, apart from others, are due to subsidence, falling of loose rocks and muds.

7.1.2 Water-Quality Impacts

Rat-hole coal-mining can produce significant impacts on surface and ground water. Megahalaya being the wettest place on earth, further aggravates the water pollution and sometimes the whole mine area gets submerged. Major sources of water quality impacts can be identified as (a) mine water pumped out during drainage operations; (b) leachates and wash-offs and domestic effluents; (c) contamination of water bodies.

Acid mine drainage is produced wherever a mine of any type in permeable formations interacts with the water table, aquifers, perched water body, or where surface water finds its way into mines in terrains where sulphides (particularly pyrite) are present. The Khyrokla (Wahkhyroi) river bed in Jaintia district is found reddish since the river is carrying coal mine effluents.

	Ph	Fe	Mineral Acidity
Khyrokla River Bed	3.10	9.0 mg/litre of H_2O	28.75 mg./litre of H_2O
ISI Standards			
Drinking Water	6.5-8.5	0.30 mg/litre of H_2O	Nil

7.1.3. Air quality impacts

The activities contributing to air pollution in this area are by transportation of coal and over-burden dump. Suspended particulate matter, dust and gaseous emissions may be the most likely impacts from the various mining operations. The vehicular movement in the area further aggravates the air pollution.

7.1.4 Ecological impacts

Loss of vegetative cover results in increased soil erosion, degradation of soil quality, loss of fertility and aesthetic condition. The unique bio-diversity, which includes endangered and endemic flora and fauna will be lost forever.

7.2 Prediction of Impacts

The potential extent and nature of identified impacts must be predicted. This includes the causes and effects, which include secondary and synergistic consequences on the environment. Prediction is used to estimate the change in the environment and its subsequent effect on air, water quality, socio-economic, land-use, landscape and ecology.

7.2.1. Land-use and socio-economic

Environmental impact assessment should predict the following impacts:

(i) changes in land-use/landscape which may include forests, agricultural, residential or recreational areas;
(ii) changes in population size, temporary or permanent, housing and employment.
(iii) Employment facilities generated by mines, etc.

In addition, prediction should also take into consideration changes in the long run and the land use involving reclamation of over-burden dumps and abandoned land need to be looked into.

7.2.2. Water quality impacts

The impact prediction in water quality should involve surface and ground water, changes in drainage systems, and chemical pollution from spoil helps including acid pollution. Surface water impacts may be predicted by comparing the discharge factors of the proposed site and sites already in operation. Mathematical models may be applied for the prediction of ground water impact.

7.2.3 Air quality impacts

Prediction of impact on air quality involves various factors such as physical properties of coal, handling, storage and transportation methods, local topography, vegetation etc. Apart from different methods, a graphical screening model can be used for predicting air pollution concentration in and around roads.

7.2.4 Ecological impacts

It is essential to predict the direct, indirect, short term, long term, periodic, permanent and cumulative ecological impacts. These should include habitat destruction, vegetation, damage, erosion, etc. Some direct impacts such as habitat loss and fragmentation by land-take can be measures in terms of areas of sites affected.

7.2.5 Assessment of significance of impact

It is important to assess the significance of predicted impacts. Tremendous impacts made on water, ecology, land-use and local residents need to be considered. These may include health, employment opportunities, flora, etc. Moreover, the impacts generated by rat-hole coal mines must stay within the prescribed standards. The prediction of impact on water and air is quite complex and the skepticism of meeting recognized standards remains. Criteria such as laws, guidelines on emissions and government policy on public opinion can be useful in assessing the impacts of coal mines. Assessment of the following criteria will be useful in the coal mines:

- Guidelines on the reclamation of abandoned land over-burden dumps.
- Guidelines covering design and construction of new infrastructure.

In the rat-hole coal mines, specific evaluation criteria should take into account the receptors of impacts in the area and the specific nature of the possible impacts. The evaluation criteria for water impacts should require.

- that the chemical quality of water shall not be reduced below the stipulation laid down in the guidelines;
- that the biological property of water shall not be changed by the project and the ecological value is not affected adversely;
- that flooding, drought, blockage and relevant effects are kept to a minimum;
- adequate measures are followed for affluents requiring compliance to stipulated parameters.

7.2.6 Alternatives

The number of alternatives for any underground rat-hole coal mine are restricted as the location of coal deposits are fixed. Various rat-hole coal mining alternatives are:

(i) alternative mine location (this is limited by the distribution of coal deposits);
(ii) alternative method of obtaining coal (underground vs open-cast);
(iii) alternative mining methods and use of raw materials, e.g. different transportation system, OB removal and restoration methods;
(iv) Alternative mitigation measures, e.g. different dust and noise control techniques.
(v) No action alternative in which a proposed mine does not proceed.

8. MITIGATION

Mitigation can aim to avoid, minimize, reverse or compensate for an impact. In addition, mitigation measures are always essential and important. Measures may be taken to prevent the adverse environmental effects of coal-mining and storage, and can be introduced to project sitting and mining operations. These should be evaluated in EIA, and mitigation measures need to be carefully designed and managed. Further, the following appropriate mitigative measures for rat-hole coal mining may be taken.

8.1. Land-use and socio-economic impacts

Mitigation measures of land use should involve:

(i) minimizing the impacts on the local environment and population;
(ii) ensuring the minimization of impact on land use and the reclamation of the same as soon as possible.

Hazards should be considered in detail in the project report and the EIA must ensure that sufficient precautions have been taken to safeguard both the labourers and local

Population. Such precautions should include mock safety drills, stabilization of OB dumps and fencing of hazardous areas.

8.2 Water quality impacts

Mitigation of water quality impacts is of paramount importance in coal mining projects as contamination of water can have severe and direct effects on health, agriculture and the eco-system. EIA should ensure that effective mitigative measures are incorporated and compiled with, which may include:

(i) treatment of mine water discharges (AMD);
(ii) collection and treatment of leachates and seepage from coal/OB dumps;
(iii) treatment of sediment control, etc.

Mitigation measures for ecology should include avoiding areas of high bio-diversity value and retaining areas containing endemic flora/fauna during mining operations and restoring disturbed wild life habitats to the pre-mining stages.

For mitigating visual impacts – green belt development and recreational projects should be implemented.

8.3 Air quality impacts

Minimisation of air quality impacts must be considered in EIA as the operation of coal mines significantly increases air pollution. Amelioration of dust emissions from coal mines may include:

- using long life roads and plantation on either side of the road;
- regular spraying of water on the road;
- prevention of over-loading and spillage from trucks;
- controlling dust and OB dumps.

A variety of mitigative methods and measures may be adopted for minimizing the environmental impacts. But the success of these measures depends entirely on the sincere commitment of the project proponent and other workers.

9. HOW IS IT RELEVANT?

More than 90% of the coal mines in Meghalaya are privately owned and the age-old practice of rat-hole coal mining has been going on up to this day. The Ministry of Environment and Forests, Government of India, in 1994, issued a Notification under the Environmental Protection Act (1986) stating the requirements and procedures for seeking environmental clearance for development projects. Among the 29 listed projects – mining forms one of the projects that require environmental clearance. However, none of the rat-hole coal mines in the state has environmental clearance or an environmental
management plan. This has resulted in massive deforestation (which was already damaged by shifting cultivation), water, air, visual and noise pollution and health problems for the local residents.

Environmental Impact Assessment studies do not hold relevance here as long as the rat-hole coal mines are not under pressure of mandatory environmental clearance. The other ideal way would be dissemination of environmental awareness both beneficial and adverse by organizing meetings, seminars, training days, showing audio-visual cassettes to the public, involving local heads, members of autonomous district councils, NGOs and, of course, the mine owners. They should try to disseminate the importance and feeling for the environment and how our own survival depends on our being able to live in harmony with nature. This type of interaction should try to inculcate the mine owners into the importance of an EIA. Study and the scientific environmental management of the coal mines in a sustainable way.

The local village head or Dorbar .Shnong (who are powerful in the locality) in consultation with the villagers/public, may prepare criteria at the planning stage for making the EIA study mandatory for the mines, to be followed by environmental management plans in an effective way. Mitigating measures such as reclamation of the abandoned mine areas, compensatory afforestation, spray of water on the haul road and control of dust, etc. must be undertaken. Preparation of an EIA by a single mine owner may not be feasible cost-wise. In such an eventuality, a combined common EIA study may be carried out by a dozen of coal mines to be followed by compliance to plans. To make it effective, incentives may be introduced.

10. CONCLUSION

Many project promoters consider the preparation of EIA as an unnecessary hindrance to rapid progress of the project, whereas some think that the EIA is basically a step required for clearance of a project. But, the formal provisions for environmental impact assessment as an integral element of project approval, decision making, now exist in many countries. The quality of EIA practice is variable but the scope for improvement is there with growing experience, proper guidance and training. The protection of the environment is a national concern since all of us, man and women, rich and poor, old and young, use and abuse natural resources. This report has attempted to illustrate how the concept of environmental impact assessment might be adopted to have a beneficial environmental effect within the frame-work of a traditional mining system which is currently having damaging environmental consequences. Finally, “when people put environment first, development will last”.

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