International Journal of Environmental Engineering and Management.
ISSN 2231-1319, Volume 4, Number 3 (2013), pp. 245-250

http://www.ripublication.com/ ijeem.htm

Environment Impact Assessment of Coal Mining

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Abstract

Environmental impact assessment is a decision making tool to predict the effect of a proposed activity/ project on the environment, to compare various alternatives for a project and to identify best combination of economic, environmental and social costs and benefits. Coal mining is the process of extracting the coal from the deep underground mines in the earth crust. Coal mining is one of the most illegal activities going on in the country. At the same time it totally neglects the role of EIA in its pre-operational, during mining and post operational plans. Here various case studies of coal mining are done and the impact of coal mining to the environment is looked into with some measures to mitigate this problem with proper use of technology and generation of awareness. The impact of coal mining on land, water, health of workers, air and social impact on surrounding villages and cities is evaluated and environment management plan of coal mining is developed. Therefore, the coal has to be used sustainably as coal reserves are depleting rapidly.

1. Introduction

Coal is a non-renewable fossil fuel Formed from the remains of plants that lived and died about 100 to 400 million years ago. Depth, thickness, and configuration of minerals resource decide the selection of mining technology (open cast or underground).Minerals exploitation progresses through four stages: Prospecting means search for deposits. Exploration: Once the deposit is assured, this is done to assess the size, shape, location and economic value of the deposit. Development - Work of preparing access to the deposit so that the coal can be extracted Exploitationmeans

extraction of coal. Depending on the content of volatiles, coal is classified into Lignite, Sub-bituminous coal, Bituminous coal and Anthracite. Open cast mining and underground mining (room pillar, long wall, drift, shaft, slope mining) are some types of coal mining. Proper Environment impact assessment of coal mining is very important and here we take some issues which should be considered and some mitigation measures are discussed.

2. Environment and Social issues related to coal mining

Coal mining has significant impact on land and land use, some of the land related impact are: Loss of biodiversity, Economic loss or loss of livelihood due to displacement and encroachment of agricultural land and Impact on water resource (in term of water availability and quality). Open cast mine has significant impact on land as compared to underground mine.

1) **Land** - Around 4 ha of land is damaged for every million tons of coal mined by the surface mining. For instance, a capacity of 10 million-tons opencast coal mine in 20 years has a potential to destroy around 800 ha of land
2) **Air** - Mainly in the form of Fugitive Dust. Most mining operations generate dust such as Drilling, blasting, Vehicles movement on haul roads, Collection, transportation and handling of coal, Screening, sizing and segregation and storage.For example, a coal stack of 50,000 tonnes can generate 250 tonne of fugitive dust even if assuming loss of only 0.5 per cent as fugitive dust.
3) **Water** - Breaching of groundwater affects the local water availability. High risk to alter the water quality of areas e.g. low pH, increase in total solids, TDS and heavy metal concentration. Acid mine drainageproduced by the leaching of sulphide minerals present in the coal leaves a Direct impact on drinking water quality,aquatic life and corrosion of equipment and structures. Trace of arsenic and hexavalent chromium around 0.05 ppm has been found.
4) **Solid Waste** - Overburden of organic material and soil that overlie a mineral deposit. Overburden generation is denoted by stripping ratio which is the ratio of overburden that needs to be removed to the amount of ore removed. Low stripping ratio translates into low quantities of waste. Mining operation results in excavation of large quantities of top soil. It is precious as it holds nutrients and is essential for successful rehabilitation and afforestation.Top soil management and its reuse are important. Poor storage can lead to run-off.
5) **Noise and vibration** - Cumulative effect of mining activities produces considerable noise like blasting, drilling, crushing and movement of vehicles. Blasting results in ground vibrations and if there are human habitation nearby, it can destroy property and houses
6) **Occupational health** - The workers in mine have high risk of the occupational diseases:Pneumoconiosis: Due to inhalation of coal dust. Can cause severe lung

problems and lung cancer, Dust allergy and asthma, Noise hazard such as temporary or permanent hearing loss, headache and high blood pressure.

7) **Mine fires** -an issue for not only the workers but also the people living in adjoining area is a major problem. Jharia coal mines:In 1972, there were reportedly, 70 active fires over an area of 17 sq.kms. Presently 9 sq. km is still affected by fire even after spending Rs 115 crores. Raniganj coal mines:Out of 850 hectare land in Raniganj town, 90 hectares affected by fire and subsidence.
8) **Socio – economic factor** - Coal mining affects communities at multiple levels.

During mine's opening – Displacement, Loss of livelihood

During mine's operation - Pollution impact (air, water, noise, vibration), Health impact

Mine closure - Sudden economic halt and Land contamination

Parameter	Waste water discharge from ledo mines	Stream water sample D/S of the mines
Ph	3.61	3.28
Cadmium	7.4	0.5
Chromium	455	73
Lead	4846	1098
Arsenic	226	60.1
Mercury	119	14.5

This table shows the condition of a coal mine in Assam, Coal has high sulphur content and thus problem of AMD – Ledo, Tirap and Tikak.Ground waterand surface water contaminated.

3. Mitigation and Environment management plan

EMP is a framework for the implementation and execution of mitigation measures and alternatives. Ideally EMP should covers all phases of project development i.e. Pre-construction, Operation of mine and Decommissioning of the mine. It is a Documented plan Containing details of impacts, recommended mitigation and monitoring measures etc and Legal document based on which the performance is monitored

1) **Top soil management** - The best practices for topsoil management is toScrap the topsoil prior to drilling and blasting, Scraped topsoil should be used immediately for plantation/agriculture, If it is not possible to use the topsoil immediately, then it should be stacked at a designated area, Storage must be done in a pyramidal form, with garland drains all around.
2) **Overburden management** - If an external overburden dump is unavoidable, then it should be stabilized with biological reclamation .Excavation from a new pit should begin after an existing pit has been exhausted. This would ensure that the overburden and interburden generated is used for backfilling the exhausted pit, instead of being dumped elsewhere.Till a pit is exhausted, the

overburden should be compacted and stacked in specified locations in low-lying, non-mineralized zones within the lease area.Vegetation should be planted over the dump slopes as early as possible.The height and slope of the overburden dumps should be maintained to prevent slope failure.Sedimentation tanks should be constructed to treat run-off from external overburden dumps. For external overburden dumps, the bench height should not exceed 10 meters and the final dump height should not be more than 60 meters. For Gondwana period rock strata, the slope should not exceed 28 degrees.

3) **Subsidence management** -Planned subsidence by considering surface structures and human lives, as in the case of long-wall mining. Preparation of a subsidence management plan and its approval by the regulatory agency. The plan should ensure the following:Simultaneous stowing of the de-coaled area. Compensation to and rehabilitation of the affected people. Fencing of the subsidence zone during active mining operation to prevent unintended entry into the affected area. Reclaiming the subsided area by afforestation. Regular monitoring and inspection of subsidence area to detect any subsidence and taking the necessary steps.Preparing a subsidence monitoring programme that covers the impact of subsidence on surface and groundwater (quality and quantity) and its management
4) **Management of water pollution** - Use of mine seepage water (after treatment) for different purposes, Construction of gabbion wall, garland drain, siltation pond, wherever appropriate and Coal stockpiles, overburden and topsoil should be selectively placed in a stable area which is less prone to erosion.
5) **Mitigation measures for air pollution** – fixed and mobile water spraying on the haulage roads. Asphalting of the road junction meeting public roads. Covering of the trucks carrying ore with tarpaulin. Wheel wash system. 9 inch free board for all the trucks. Green belt around mining area as physical barrier.
6) **Mitigation of noise and vibration** –
   Use of closed and advanced blasting technology like shock tube technology
   Conducting blast only during day time, use of hydraulic drills and provision of sound insulated chambers for workers deployed on machines producing higher levels of noise like bulldozers, drills etc.
   Enclosing crusher units in covered buildings to minimize sound propagation.
   Providing silencers or enclosures for noise generating machines such DG sets, compressors etc.
   Creating a green belt around potential noise prone area and provision of protective devices like earmuffs/earplugs to workers, who are exposed to high level of noise and reducing the exposure time of workers by practicing worker rotation.
7) **Mine closure plan** - A good mine closure plan should include the following:A detailed final closure plan to create productive and sustainable land use,The plan must be accepted by mine owners, regulating agencies, and local

communities, A plan to protect the health and safety of the surrounding habitat and A plan to eliminate/contain all possible sources of pollution post-mining.

8) **Mitigation of occupational health and safety issues** –

Activity	Mitigation measures
Drilling and blasting	Driller shall be equipped with a closed cabin to reduce exposure to noise and dust. In addition, the operators and other workers should be provided with masks, helmets, gloves and earplugs.
Safety zone	Provisions should be made for a buffer zone between the local habitation and the mine lease in the form of a green belt of suitable depth. Restricted entry, use of sirens and cordoning of the blasting area are some of the good practices to avoid accidents.
Workers health surveillance	Health survey programmes for workers and local community. Regular training and awareness of employees to be conducted to meet health and safety objectives
Mine inundation	Mine inundation may lead to a serious disaster if a river is flowing close to the mine pit. Hence a buffer space of a suitable width should be maintained, which should be followed by construction of embankments after considering high flood level. In underground mines, if the shaft is located in a low lying area or is vulnerable to flood risk, garland drains should be provided around the shaft.
Mine fires	Try to extinguish the new fires and try to isolate existing fires. Try to take a scientific approach to mining practices and give due consideration to proposed fire prevention plans. Carry out monitoring using new scientific techniques. Risk of explosions in underground mines can be managed by good mine planning, methane gas monitoring, good ventilation and controlling dust levels.

Dust Collection Efficiency	Plant Species		
	Herbs	Shrubs	Trees
Low <10%	1.*Amaranthus hypchondriceus* (Chaulai) 2. *Gardenia jasminoides* (Crape Jasmine) 3. *Cestrum nocturmum* (Rat Ki Rani) 4. *Chrysanthamum species* (Crown Daisy)	1.*Thuja species* (Moyur Pankhi) 2.*Ravuvolfia serpentine* (Serpgandha) 3.*Withania somnifera* (Ashawagandha) 4.*Acanthus species* (Acanthus)	1.*Nyctanthese arbortritis* (Harsingar) 2.*Abis pindrow* (Silver fire) 3. *Accacia nelotica* (Babool) 4.*Holarrhena antidysentrica* (Kurchi) 5. *Clerodenrum inerme* (Glorry bower) 6. *Ficus bengalensis* (Banyan) 7.*Miliusa tomentosa* (Kari Leaves) 8.*Thespesia populania* (Ran Bhindi)

Dust Collection Efficiency based Low, Moderate & High Dust Capturing Herbs, Shrubs and Trees.

Reference

[1] http://www.cseindia.org/content/eia-analysis-coal-mining-project-ms-jayaswals-neco-limited
[2] http://www.cseindia.org/node/466
[3] EIA analysis of coal mining project by Jindal Steel and Power Limited | Centre for Science and...
[4] Dr. Gurdeep Singh, environment impact assessment of mining projects, proceedings of international conference on TREIA-2008, Nagpur, november 23-25, 2008
[5] http://www.accountabilityproject.org/downloads/Summary%20Environmental%20Impact%20Assessment%20.pdf.
[6] http://www.sciencedirect.com/science/article/pii/S019592550200006**9**
[7] http://www.sciencedirect.com/science/article/pii/014890629590025Z
[8] http://www.sciencedirect.com/science/article/pii/S0166516211000206
[9] http://www.sciencedirect.com/science/article/pii/S0195925512000078
[10] An assessment of EIA system in India