

Environmental Challenges & Control Measures of Mining In India



Engineering

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ABSTRACT

Coal is vital for its energy security, as it is the most important fossil fuel in India. It is India's Least-cost source of primary energy and currently meets two-thirds of the country's energy needs. The power sector is the largest consumer, followed by the industrial sector—the major consumers being steel, cement, and brick-manufacturing units. Coal therefore remains essential in achieving a diverse, balanced and secure energy mix. While coal is poised for significant growth, it faces significant and mounting social and environmental challenges. Environmental concerns will be the key to the coal industry's future. Relative to other fossil fuels, coal is less energy efficient and pollutes more. The primary concerns at the regional levels have to do with the environmental impacts on air, water, land, forest, biodiversity, climate and the costs of mitigating these. Even with its major hurdles, coal will remain a future mainstay, a foundation and a fundament of our economy. Coal has a crucial role in meeting current needs and is a resource bridge to meet future goals through the enhancement of knowledge and technology, the challenge is to apply the right technology in the most efficient and environmentally friendly way.

INTRODUCTION

Coal is the most abundant fuel resource in India. It is the prime source of energy and perhaps the largest contributor to the industrial growth of the country. It is a crucial and enduring element in a modern, balanced energy portfolio, providing a bridge to the future as an important low cost and secure energy solution to sustainability challenges. Some important facts about coal industry in India are as follows: " India is the third largest producer of coal in the world " Coal is one of the primary sources of energy " India has some of the largest reserves of coal in the world " Indian coal has high ash content (15- 5%)and low calorific value " With the present rate of around 0.8Mt average daily coal extraction in the country, the reserves are likely to last over a 100 years The energy derived from coal in India is about twice that of energy derived from oil, as against the world, where energy derived from coal is about 30% lower than energy derived from oil " Coal India Limited (CIL) is the largest company in the world in terms of coal production Coal continues to be the major source of primary commercial energy worldwide. Considering the limited reserve potentiality of petroleum and natural gas, eco-conservation restriction on hydel projects and geo-political perception of nuclear power, coal will continue to occupy the centre stage of India's energy scenario. Share of coal in world's energy consumption is 27%. The importance of coal in India can be gauged by the fact that it supports about 54.5% of the commercial energy in the country. The coal production in India has risen from 73 Mt in 1972 to about 382 Mt in 2004-05. Coal demand as projected for the year 2006-07 is 448 Mt, for 2011-12 is 620 Mt and is projected to 1061 Mt by the end of 2024-25.

ENVIRONMENTAL CHALLENGES

Mining activities have to be carefully planned and controlled the operations like drilling, blasting, extraction, transportation, crushing and other associated activities in underground and opencast mines. In case of failure in the activities within the stipulated rules and litigations, Mining operations damage the environment and ecology to an unacceptable degree. There is a need for balance between mining and environmental requirements. The various impacts of mining on environment and their mitigation measures are as follows:

Impact of Mining on Air Quality

Air pollution in mines is mainly due to the fugitive emissions of particulate matter and gases including methane, sulphur dioxide, oxides of nitrogen and carbon monoxide. Most of the mining operations produce dust. The major operations producing dust are drilling, blasting, hauling, loading, transporting and crushing. Basically, dust sources in mines can be categorized as primary sources that generate the dust and secondary sources,

which disperse the dust and carry it from place to place called as fugitive dust. Opencast mining is more severe an air pollution problem in comparison to underground mining. High levels of suspended particulate matter increase respiratory diseases such as chronic bronchitis and asthma cases while gaseous emissions contribute towards global warming besides causing health hazards to the exposed population. The uncontrolled dust not only creates serious health hazard but also affects the productivity through poor visibility, breakdown of equipment, increased maintenance cost and ultimately deteriorates the ambient air quality in and around the mining site. The dust can also pollute nearby surface waters and stunt crop growth by shading and clogging the pores of the plants. Besides polluting the environment, the generation of dust means the loss of fines, which act as road surface binders. Problem with greenhouse gases, acid rain and ground level ozone The key environmental challenges facing the coal industry are related to both coal mining and the use of coal - greenhouse gases, acid rain and ground level ozone, issues which can be local, regional and global in their impacts.

The greenhouse effect is a natural phenomenon which refers to the increase in the earth's surface temperature due to the presence of certain gases in the atmosphere. There is concern that this natural phenomenon is being altered by a greater build up of gases caused by human activity. This is known as the enhanced greenhouse effect. The combustion of coal, like that of other fossil fuels, produces CO₂, a gas that is linked to global warming through the greenhouse effect. The combustion of coal produces gaseous emissions of sulphur dioxide (SO₂) and nitrous oxides (NO_x) that are responsible for the production of 'acid rain' and 'ground level ozone'. Acid rain occurs when SO₂ and NO_x gases react in the atmosphere with water, oxygen and other chemicals to form acidic compounds. Ground level ozone (O₃) is mainly responsible for smog that forms a brown haze over cities. Ground level ozone is formed when NO_x gases react with other chemicals in the atmosphere and is enhanced by strong sunlight. Emissions of SO₂ and NO_x are termed transboundary air pollution because the environmental impacts from the production of these gases are not restricted by geographical boundaries.

II. Impact of Coal Mine Fires

A number of coal mines in the country are affected by fires leading to steady destruction of precious energy resource. The reason for mine fires presumably involves the phenomenon of spontaneous heating through two interrelated processes viz., the oxygen coal interaction or oxidative process and the thermal process. If remains uncontrolled, the fire could spread further through interconnected pathways and fissures in the strata. It is estimated that about 10%

of total national coal resources are in the fire-affected areas. Mine fires give rise to several environmental problems besides safety hazards and economic losses. Apart from direct losses due to burning of coal, the other associated hazards encountered are: i) gas poisoning, ii) difficult geo-mining conditions, iii) sterilization of coal, iv) hindrance to production v) explosions, vi) damage to structure and adjacent properties, etc.

(III) Impact of Mining on Water regime

Disturbance to hydrologic regime Mining and its associated activities not only uses a lot of water but also affects the hydrological regime of the district and often affects the water quality. Large and deep opencast mines usually have great impact on the hydrologic regime of the region. The major hydrological impact of a large and deep opencast mine, however, is on the ground water regime of the region. The water seeping into the mine and collected in the mine sump is partly used up in the mine and the excess amount is discharged into the surface drainage system. The water used up in the mine for spraying on haul roads, conveyors, at loading and unloading points, bunkers etc. are lost by evaporation. A deep mine is likely to have longer haul roads requiring more spraying water. The water used for green belts and plantation areas are also lost by evapor-transpiration. Many areas of the country are faced with the problem of over exploitation of ground water resources resulting in alarming lowering of water table. Therefore a lot of care has to be taken in estimating the water need and the mines of future are likely to be subjected to a lot of constraints on water use and discharge Acid Mine Drainage Acidic water results in severe water pollution problems. Acid Mine Drainage (AMD) refers to distinctive types of waste bodies that originate from the weathering and leaching of sulphide minerals present in coal and associated strata. Environmental effects of AMD include contamination of drinking water and disrupted growth and reproduction of aquatic plants and animals. Effects of AMD related to water pollution include the killing of fish and loss of aquatic life and corrosion of mining equipments and structures such as barges, bridges and concrete materials. AMD is the most persistent pollution problems in mines of North Eastern Coalfield. Generally, water quality characteristics of acidic mine water reflect high acidity and high hardness along with high iron and sulphate contents. Various toxic trace/ heavy metals become soluble in acidic water and may be presenting significant to concentration levels depending upon their availability in the source material. Fortunately the considerable majorities of coal mining areas are safe and only in a few localized areas problem of AMD exists. AMD cripples the economy of mines due to compliance of stringent environmental standards and involves huge cost burden in its management.

(IV) Impact of Mining on Land

Irrespective of the type of mining used for extracting coal, mining invariably results in enormous land disturbance- e.g. large scale excavation, removal of top soil, dumping of solid wastes, cutting of roads, creation of derelict land etc. The mining industry, in general, is reluctant to rehandle overburden material for economic reasons but in a few cases it has been planned to rehandle the material to fill the voids created at the end of mining, and it is expected that the practice will become more widespread in future. Opencast mining has more potential impact on land than underground mining. With improved technology, opencast coal mining is being used extensively because of its cost effectiveness and productivity though it results in large-scale land disturbance. Although underground mining has considerably less impact than opencast mining on land, it causes enough damage through subsidence as observed in Jharia and Raniganj Coalfields. The surface subsidence inflicts severe damages to engineering structures such as highways, buildings, bridges and drainage besides interfering with ground water regime.

(V) Impact of Noise and Vibrations from Mining

A cumulative effect of all mining activities produces enormous noise and vibrations in the mining area, which constitutes a source of disturbance. The availability of large diameter, high capacity pneumatic drills, blasting of hundreds of tonnes of explosive etc. are identified as noise prone activities. Input crush-

ing system with mobile crusher and large capacity materials handling plants are being installed to facilitate speedy handling of large quantities. All these activities are major sources of noise & vibrations in and around the mining complexes. The obvious implication of noise is, of course, the potential for noise-induced hearing loss. In addition, noise produces other health effects, influences work performance and makes communications more difficult. Besides, the fauna in the forests and other areas surrounding the mines/industrial complexes is also effected by noise and it has generally been believed that wildlife is more sensitive to noise and vibrations than the human beings.

EXAMPLE OF BEST CONTROL MEASURES

Coal India Limited (CIL)

- Mining-induced displacement and resettlement (MIDR) increased substantially since the 1970s as the countries coal production shifted from underground to opencast mining. The issue has gone beyond economics and environment; local NGOs, such as Operations Research Group (ORG), a consultant of Coal India Limited (CIL), reported that MIDR is creating a pattern of "gross violation of human rights," and "enormous trauma in the country." By the mid-90s, Resettlement and Rehabilitation (R&R) Policy of CIL has been designed to ensure that affected people improve or at least regain their former standard of living and earning capacity after a reasonable transition period. Coal India Limited implemented the Environmental and Social Mitigation Project (ESMP) in 25 selected opencast mines with World Bank funding during 1996 to 2002. Environmental and Social Mitigation Project (ESMP) aimed to mitigate adverse effect of coal mining on environment and people affected by such activities. ESMP consisted of two components:
 - Environmental component - implemented through Environmental Action Plan (EPA). Social component - implemented through Rehabilitation Action Plan (RAP) and Indigenous Peoples' envelopment Plan (IPDP). Environmental Action Plan (EAP) includes Domestic Effluent Treatment Plant, workshop Effluent Treatment Plant, Mine Water Discharge Sedimentation Plant, Dust Suppression Majors, Tree Plantation, OB Dump Reclamation, Top Soil Storage and Spreading for Bio Reclamation, Environmental Monitoring. Environmental Measures Adopted Air Pollution Control Measures · Water spraying on haul roads by mobile and fixed sprinklers: The coal transport road was covered under water spraying scheme either with the help of road side static water sprinklers or mobile sprinklers. · Dust extractors in the Coal Handling Plants and drilling equipment: All the excavation drills have been equipped with dust extractors. · Black topping of service roads: The coal transportation roads have been black topped with arrangement of collection of the coal dusts and removing the same periodically. Besides, the coal transportation contractor has been cautioned not to overload the truck which may cause spillage generating dusts due to crushing by running trucks.
 - Avenue plantation: Forest Department has been engaged for plantation on roadsides besides plantation on the OB dumps and other empty lands. · Dust masks: The excavation equipment operators have been issued with dust masks.

Water Pollution Control Measures

- Industrial effluent treatment plants: Effluent Treatment Plants (ETPs) have been constructed in the down flow line of the workshop as well as mine discharges so that pollution parameters in the effluents are well within acceptable norm. Many of the mines could reach the 'zero discharge' arrangement targeted for. · Silt arrestors/ Siltation ponds/ Sedimentation ponds: Catch drains terminating at sedimentation ponds have been constructed garlanding the OB dumps to arrest flow of silts to the rivers/ nalas.
- Treatment Plants (STPs): STPs have been constructed to take care of the domestic effluents in all the mine colonies of the project replacing the conventional safety tanks. The treated effluents are being utilized for dust suppression and being supplied to the agreeable villagers for irrigation.

Noise & Ground Vibration Control Measures

Following actions are adopted to keep the noise level within the statutory limit in day as well as nighttime. · Use of Controlled blasting techniques. · Green belts around colonies and mine areas. · Proper maintenance of heavy Earth Moving Machinery. · Issue of earmuffs to the excavation workmen. Rehabilitation Action Plan (RAP) includes Shifting of villagers affected by mining, Resettlement and rehabilitation of project affected families (PAFs) by giving a plot of land in well developed resettlement sites or a lumpsum package to settle at a place at their choice. The PAFs are also trained in different trades for their economic rehabilitation. Under Indigenous People Development Plan (IPDP) villages falling within one kilometer area from the leasehold of the mines are considered. Activities under IPDP include 1. Development of Community infrastructure like School Building, Community Hall, Dispensary Building, Village Roads, School Furniture, Wells, and Tube wells etc. 2. Community Activities like Mahila Mandal, Youth Club, Self Help Groups, Sports, Cultural Programmers' etc. 3. Training & Capacity Building, Training for self-employment, Non-formal Education etc. Overall environmental management improvement has been taking place with

the implementation of state-of-art environmental management schemes particularly under Environmental and Social Mitigation Project (ESMP) of CIL.

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