

Impact of Mining Activity on environment: An Overview

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Abstract- Mineral is very important for any country to progress and their economic wealth therefore many mines developed, open and underground both but on another hand it is affected our environment directly and indirectly both. Due to adaptation of heavy machinery with increased production of overburden thus provocative the existing environmental challenges. The environmental problems increases due to mining activities such as Land degradation ,loss of forest and biodiversity ,Soil contamination ,Air pollution, Surface and ground water pollution, noise pollution . For decreasing the problem Stakeholders and Government should aware about the Rules and Regulation which comes under "TheEnvironmentalProtectionAct,1986".This paper represents the assessment of environmental impacts of mining activity on environment such as soil erosion, ecological disruption, air and water pollution, and health etc. and National Mineral Policy2019.Therefore,management of a country's mineral resources must be closely associated with overall economic development, environmental protection & preservation strategies .Most countries throughout the world require some form of environmental impact assessment(EIA)of major mining projects expected to have significant impact on the quality of the human environment, before such projects can be approved and undertaken.

Index Terms- Mining, biodiversity, soil erosion, air pollution ,noise pollution, ecology, society , stakeholder, Environmental Protection Act,1986,environmental impact assessment ,national mineral policy,2019.

I. INTRODUCTION

Minerals are important parameter of the national economy of any country. India is fortunate with considerable mineral resources. Maximum part of land is under mining - a substantial portion of which covered by forest areas. There are about 20000 known mineral deposits in India and as many as 89 minerals (4 fuel, 11 metallic, 52 non metallic and 22 minor minerals) are produced worth Rs. 73944.59 Crore. (Annual Report 2004-05, Ministry of Mines).Open cast mines as well as underground mines Both types of mines affected the environment .Open cast mining operations result in dumping of overburden on un mined area which is consolidated and unconsolidated materials overlying the minerals ,and is required to be removed. One of the major environmental challenges is to manage overburden generated in these open cast mines which is associated with the problems of loss of topsoil, soil erosion, water and air pollution, noise pollution ,loss of forest and biodiversity, ecological disruption, social problems, and health etc.

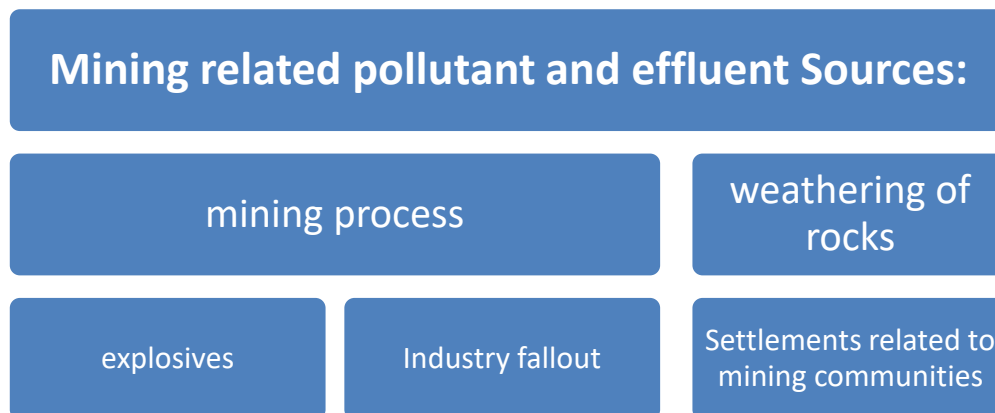


Fig. 1

Impact on water

- Reduction in availability of water in the area as mining uses lot of water
- Removal of water bodies from the area for quarrying ,dumping.
- Disruption of drainage pattern.
- Disruption of hydrological regime, ground water regime and lowering of ground water table

- e. Pollution of surface and ground water bodies due to discharge of mine water, run off from coal stocks and overburden dumps especially domestic effluents rendering water unfit for domestic use and in some cases even for agriculture purpose.
- f. Acid mine drainage(AMD)due to presence of pyrite bands in coal seams may result in toxic/heavy metals.Toxic water includes the contamination of heavy metals such as lead(many mining belts of Chattisgarh and M.P.), mercury [across the India but coastal city like Mumbai, Kolkata ,Karwar (in Karnataka) and North Koel(in Bihar)] are some of the severely affected areas and uranium (Rajasthan, Jharkhand, Punjab)and other pollutants such as arsenic(Bihar, Jharkhand and West Bengal) .
- g. If subsidence movement on the surface exceeds the safe limit for the surface water bodies, it becomes necessary to drain them out.
- h. Overlying water bodies are disturbed and water from them finds way into the underground workings .This water is required to be pumped out from the mine.
- i. With development of cracks upto the surface, rain water from surface finds its way underground.Theis may carry with it various pollutants from surface.
- j. Polluted underground water when pumped out and discharged on surface ,may result in pollution of pollution of surface water bodies.
- k. Dumping of overburden should be avoided from mines in valleys or depressed tracts on the side of mined area that constitute the basic source of water supply either from surface or groundwater bodies (Nriagu, 1988).In Jamarkatra phosphorite mines,this impact is reflected as the major waste dumps made in the southern valley that contains the shallow groundwater and surface water for providing water supplies.

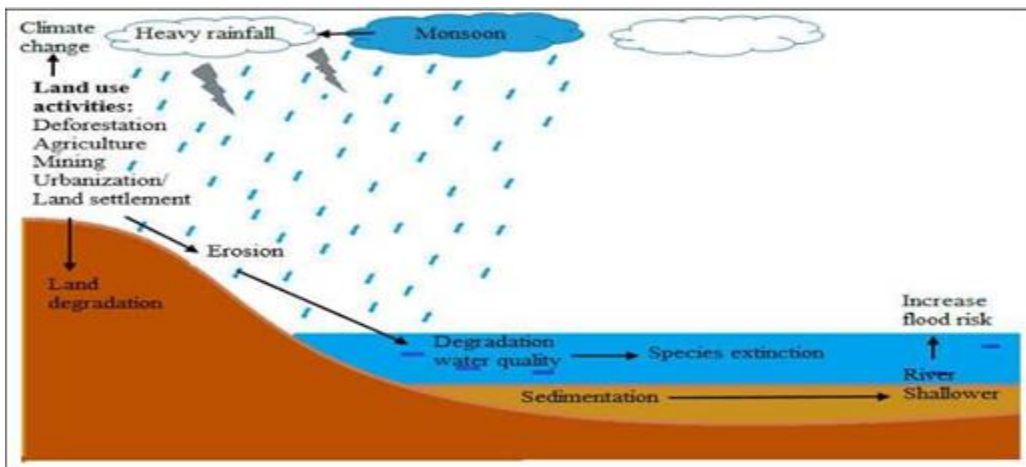


Fig. 2 The schematic diagram showing how water quality deteriorated due to mining and other activities.



Fig. 3 The above photo is taken from Karnataka Lokayukta report-(2006)

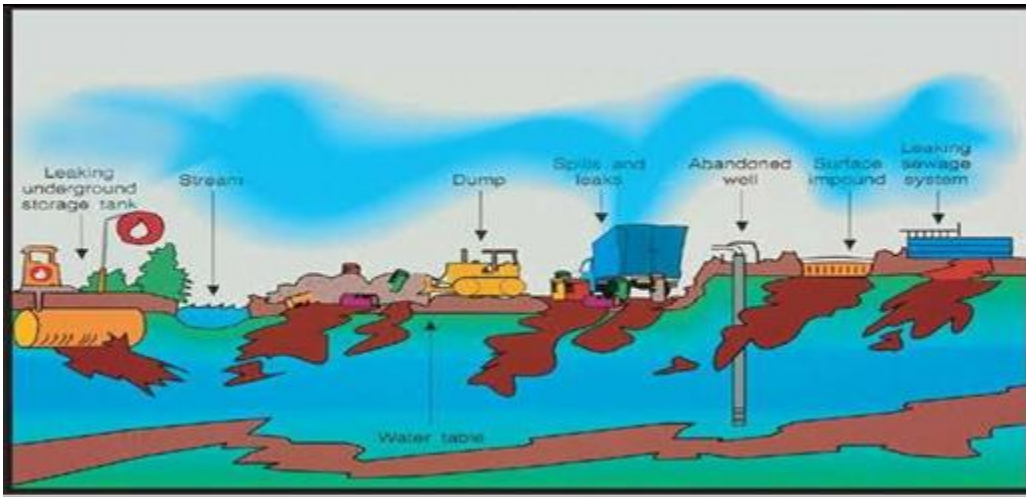


Fig.4The figureshowingminingactivitiesdegradesthequalityofsurfaceand sub- surfacewater.

IMPACT ON LAND

- a. Biggest impact of open cast is on land-almost 85%of the total adverse effect.
- b. There is massive land disturbance due to use of land for large scale excavation ,dumping of overburden, making industrial and service building ,roads and other infrastructure , township etc. effect is severe if it involves forest land ,agriculture land or inhabited land. In case of forest land, impact depends on whether it is degraded forest or thick forest, and whether area is supplying unique habitat, endemic or threatened species. Inhabited land involves displacement of people. Change in land pattern use pattern – agriculture land used for residential and industrial purpose-reduces agricultural production.
- c. Soil erosion and soil degradation due to a wide-range of environmental unorganized activities in general and mining in particular have been extensively investigated and documented by scholars and environmental activists.
- d. Alteration in characteristic of top soil reduces fertility of land/agriculture production in the surrounding area due to siltation and run off from overburden dumps.
- e. Change in land use pattern due to building construction and other infrastructure development.
- f. Change in topography and drainage pattern due to subsidence.
- g. Change in effective land use created by disturbance of surface water bodies and underground regime.
- h. Discharge of polluted water on surface affect quality of top soil. (L.c.kaku,2016)



Fig. 9 The above photo is taken from Karnataka Lokayukta report-(2006)

IMPACT ON AIR QUALITY

- a. Air pollution due to emission of gaseous pollutant(SO₂,NO_x,CO),suspended particulate matter and dust from drilling,blasting,transport of coal and overburden,crushing and screening.

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- b. Pollution from mine fires and fires in waste dumpn, including those left burning in post mining period.
- c. Auto-emissions.
- d. Emissions from soft coke bhattas and coke ovens.



Fig. 8 The above photo is taken from Karnataka Lokayukta report-(2006)



Fig. 7 The above photo is taken from Karnataka Lokayukta report-(2006)

IMPACT ON NOISE POLLUTION

- a. Mine exhaust air contributes SPM,CO₂,NO_x,SO₂, and other pollutants.
- b. Diesel generating sets ,boilers etc. contributes SPM ,NO_x and CO to the ambient air.
- c. Machinery installed in shafts/inclines ,compressor houses and workshop generates noise which becomes ambient noise.
- d. The heavy machinery operations in the overburden handling leads to an increase in the noise levels in the nearby residential areas also. However, at the planning stage the proper selection of the dumpsite can eliminate noise impacts to the residents. “Noise mapping” is preferred for visualization and its propagation in the form of noise contours so that preventive measures are planned and implemented (ABH Publishing Corporation). Although in the Recommendations of Tenth Conference on Safety in Mines, noise mapping has been made mandatory in Indian mines (as per Directorate General of Mines and Safety) , still mining industry are not giving proper importance on producing noise maps of mines.

IMPACT ON ECOLOGY

- a. Clearing of vegetation from land used for quarry ,dumping of overburden,construction of infrastructure.
- b. Deforestation when mine is situated in forest area.
- c. Disturbance in wild life and other fauna due to clearing of vegetation/deforestation.
- d. Noise and vibrates due to blasting and machine operations drive away animals and birds from the region.

- e. Retardation of growth of vegetation due to lowering of water table/disruption of waste regime, and due to air and water pollution.
- f. Degradation of aquatic flora and fauna due to discharge of polluted water.
- g. Development of shaft/incline complex, infrastructure, township etc. require clearing of the area and thereby drives away the fauna.
- h. Water table of the adjoining area gets lowered because of fractures created in the aquifer by underground mining. This has adverse effect on growth of vegetation and agricultural produce.
- i. Vegetation supporting capacity of the top soil in the tensile zone of subsiding area may be impaired.
- j. Discharge of polluted water from underground mine to surface water bodies affects their aquatic ecology.
- k. Mining is always together with environmental disorder more so, in open cast mining. Opencast mining contributes towards land degradation, vegetation degradation, destruction of productive land in addition to effecting river flow, siltation, water pollution, deforestation etc. in many cases, valuable ore bodies are in forest or impending to it. This is exactly in Karnataka and Bellary, Sandur, Chikkanayakanahalli (Tumkur) in particular open cast mining amounts to deforestation in a big way. Development of infrastructural facilities for any type of mining results in destruction of trees and vegetation.
- l. The nallas ultimately change into river or reservoir. The water pollution is caused due to increase in total solids, other minerals such as fluorite, mercury etc and leachates from the dumps of mines which are harmful for human health and aquatic fauna and flora. This results decrease the amount of dissolved oxygen of water. This activity affects the aquatic life. In surface waters, elevated concentrations of particulate matter in the water column can produce both chronic and acute toxic effects in fish and other aquatic life.
- m. Mining has damaged the biodiversity of birds, animals, medicine plants, insects, flies, reptiles, sponges etc. According to study on the NEERI Report of Tumkur, Ballary, Hospet and Sandur (TBHS) region, a total of 194 plant species were recorded, out of this, 90 are tree species, 36 shrub species and 68 herb species. There are 61 plant species (28 trees, 23 herbs, 10 shrubs) having medicinal properties found in this region. This comes out 30% of total plant species. Conservation and preservation of species in balancing mode are most important in forest areas because each and every species is having its own ecological niche and they are related one or the other way in eco-system through food chain. Since the ore production increased more than four times since 1999-2000, the impact of mining has also increased accordingly on the forest, agriculture, aquaculture and human life. It has been observed that SDI is reducing in the areas where the mining activities are more. Continuous serial stretches of mines on its hill tops in Ramdurga block, NEB block and also in other blocks have brought a sea change in the surrounding ecosystem. It is observed that most of the lessees are using exotic species for planting to rehabilitate the dumps and also other leased area, thereby creating monoculture and resulting to change the existing ecosystem in near future. A sizable number of wild animals comprising 16 species of mammals, 145 species of birds, 9 species of reptiles have been reported by the NEERI in its study during 2001-02. All these species are now at run due to noise, air, water and soil pollution generated through mining and related human disturbances (Pullaiah, T, 2006). The continuous mining activities in night have further added fuel to the fire to desert wild animals from the forest area. The fine dust generated due to mining activities including transportation, fall on the flowers, fruits, leaves etc. and inhibit setting of seeds would result to loss of biodiversity of the region (Environmental Geology- ecosystem protection in mining areas).
- n. Opencast mining activities change surface of the earth. Overburden dumps are man-made habitat causing multiple environmental problems ranging from erosion and enhancing sediment load in receiving water bodies, dust pollution, damage to fragmentation of habitat and overall disturbance of ecosystem in the whole area.
- [1] Sediments deposited in layers in terrestrial ecosystems can develop many impacts associated with surface waters, ground water, and terrestrial ecosystems. Minerals associated with deposited sediments may depress the pH of surface runoff thereby mobilizing heavy metals that can infiltrate into the surrounding subsoil or can be carried away to nearby surface waters. Contaminated sediments may also lower the pH of soils to the extent that vegetation and suitable habitat are lost. (Journal & Daily News Papers)



Fig.6 The above photo is taken from Karnataka Lokayukta report-(2006)

IMPACT ON SOCIETY

- a. Displacement of people whose land is acquired. Already marginal health status of Project Affected People (PAPs) worsened by stress and trauma of moving.
- b. Loss of livelihood of people dependent on land directly or indirectly.
- c. Influx of outsiders (officers, skilled workers, contractors, small businessmen, government officials), rapid decreases when the mine is closed. Dilution of ethnic culture of the area.
- d. Disturbance and health effects on local population and noise produced by blasting and crushing.
- e. The sanitation has been completely damaged. People are suffering from many diseases because of the deposition of dust everywhere. The mining area has high incidence of lung infections, heart ailments and cancer. The problem of dust during transportation goes unachieved to as there are no basic standards fixed and action can be taken according to Karnataka State Pollution Control Board environment officers. People are suffering from epidemic diseases due to mining activities. Pure drinking water, pure air, pure clean food has become a rare thing. The environment has lost its balance.
- f. Urbanization (well organized township, market places) when mining activity is on and leaving behind remnants when mining ends.
- g. Danger to life and property in post mining period. Rise in aspirations of society.
- h. Settlements near to the overburden dump sites are prone to the risk of mud sliding from the dumps in the case of slope failure in mine area. In that situation the entire muck etc. enters in the settlement and affects in many ways. This was the case that happened in Chilkad and Basti, nearby Khadia overburden dumps. In the meantime a channel has been constructed through the Basti to drain run-off water successfully.
- h. Impact on the labour-intensive nature of India's mining industry. Which is going on to continue as such, with further intensification despite mechanization efforts and leads for serious and sincere efforts in this vital field of environmental problem. Important factors that affect the health of workers in this regard are:
 - a. Generation of dust more particularly irrespirable dust.
 - b. Workplace environment and conditions.
 - c. Noise and vibrations, the latter particularly hand-transmitted.

Investigations on this subject by CMRs (Central Mineral Resources) in some coal mines and industrial areas of Jharia and Raniganj coal fields have revealed that 19-20% of population is suffering from respiratory diseases (Silicosis) and 23.25% from gastro-intestinal problems. Diseases like malaria pneumonia, tuberculosis, fever etc account for another 16%. (R.N.Trivedi-2001)

- i. Loss of common property resources-Common property resources (CPRs) broadly speaking, are the resources accessible to the whole community of a village and to which no individual has exclusive property right. In the dry regions of India, they include village pastures, community forests, wastelands, common threshing grounds, waste dumping places, watershed-drainages, village ponds, tanks, rivers/rivulets and river beds. The mine owners and middle man have destroyed the property and resources of many people. They have acquired community land and tanks. This has caused a lot of inconvenience to the public. Water is not collected in the tanks now, even water collected in the tanks is polluted because of the collection of dust on the surface. Forests are destroyed to bring forth deserts. (Campaigns)

Decline of CPRs can take three forms:

- a. Physical loss of resources such as the submission of grazing land in a newly constructed irrigation dam or area of CPR covered by roads and buildings.

- b. Deterioration of physical productivity of resources as revealed by degradation of pastures or forest lands.
- c. Reassignment of usage and property rights as indicated by transfer of CPR lands to private ownership.(Benny joseph,2006)

WATER POLLUTION RULES AND REGULATION

The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. The Water (Prevention and Control of Pollution) Act was enacted in 1977, to provide for the recovery and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to increase the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The Act was last amended in 2003.

NATIONAL MINERAL POLICY 2019:-

The National Mineral Policy 2019 includes provisions which will give boost to mining sector such as-

- a. Introduction of Right of First Refusal for RP/PL holders,
- b. Encouraging the private sector to take up exploration,
- c. Transfer of mining leases and creation of dedicated mineral corridors to boost private sector mining areas.
- d. The 2019 Policy proposes to grant status of industry to mining activity to boost financing of mining for private sector.
- e. It also mentions that Long term import export policy for mineral will help private sector in better planning and stability.
- f. The Policy also mentions to make efforts to harmonize taxes, levies & royalty with world benchmarks to help private sector.

THE ENVIRONMENT PROTECTION ACT, 1986 :

The Environment Protection Act, 1986 (the "Environment Act") provides for the protection and improvement of environment and matters connected with under Article 253 of the Constitution. The act was established at the United Nations Conference on the Human Environment held at Stockholm in June, 1972. In which India participated, to take appropriate steps for the protection and improvement of environment. Power of Central Government to take measures, Protect and improve environment, appointment of officers and their powers and function, Powers to give direction, made rules to regulate environmental pollution. The Environment Protection Act establishes the framework for studying, planning and implementing long-term requirements of environmental safety and laying down a system of speedy and adequate response to situations threatening the environment. It is an umbrella legislation designed to provide a framework for the coordination of central and state authorities established under the Water Act, 1974 and the Air Act .The term "environment" is understood in a very wide term under s 2(a) of the Environment Act. It includes water, air and land as well as the interrelationship which exists between water, air and land, and human beings, other living creatures, plants, micro-organisms and property .Under the Environment Act, the Central Government is empowered to take measures necessary to protect and improve the quality of environment by setting standards for emissions and discharges of pollution in the atmosphere by any person carrying on an industry or activity; regulating the location of industries; management of hazardous wastes, and protection of public health and welfare(Wikipedia).From time to time, the Central Government issues notifications under the Environment Act for the protection of ecologically-sensitive areas or issues guidelines for matters under the Environment Act for the protection of ecologically-sensitive areas or issues guidelines for matters under the Environment Act.

MITIGATION MEASURE FOR CONTROL THE IMPACT OF MINING ON ENVIRONMENT

The use of water in mining areas is very risky. Mining activities will reliably have an impact on water environment through direct or indirect contact of either the surface or groundwater. Therefore, industries must invest in ensuring that water is not contaminated or where contamination does occur, they invest in treatment or containment within appropriate reservoirs, pipelines, canals or other storage facilities. Mining industries must encourage adopting practices and technologies which are environment friendly.

The practice that must be followed by the industries is as follows:

- a. Resource conservation and management by scientific way with minimum waste, finding substitutes of the mineral widely used at present.
- b. Proper recycling of used metals.
- c. Adoption of environmental friendly technologies.
- d. Efficient use of energy.
- e. The activities of mining adversely affects the inhabitants, their health standard being compromised, their abode endangered, and their means of livelihood (especially farming) jeopardized. The government at all levels should investigate the activity of the operator and others in this area, review/re-evaluate their EIA and appraise their activity regularly and at close intervals, and adequate compensation administered appropriately.
- f. It is recommended that a detailed Environmental Impact Assessment should be carried out before Quarrying License can be obtained from government. A task force should be set up by the government to investigate operators that are not complying with Code of Practice for Quarrying activities, offenders should be prosecuted.

- g. A modality should be agreed upon by both the inhabitants, government and operator company of a proposed quarry site. Settlers should be relocated and compensated appropriately. The interest of the locals should be considered objectively during issuance of license and monitoring activity by the government. The government task force team should include geologists, engineers, environmentalists, and surveyors.
- h. Environmental control technologies
- i. Using waste as raw material,
- j. Reducing the amount of waste produced through process re-engineering. (Recycling of industrial Effluents)
- k. Minimising requirement of land by proper planning of mining and associated activities.
- l. Systematic removal, storage of top soil and reuse on reclaimed land as early as possible.
- m. Using dust extractors with drills, crushing and screening plants.
- n. Controlling mine fire.
- o. Plan mine layout to minimize disturbance of surface water bodies and drainage pattern.
- p. Rehabilitation sites to be provided with facilities like roads, link roads, street lighting, wells, tube wells, hand pumps, schools, community halls, health centres, veterinary centres, shopping centre, panchayat bhawan, children park/play grounds and tree plantation.
- q. Restore or even improve social and economic well being of the displaced population by treating Resettlement & Rehabilitation as integral component of mining, dedication proper manpower & financial resources.
- r. Select equipment with minimum noise.
- s. Drastic reduction of noise and ground vibration by coal extraction by surface miners.
- t. Proper design of blasting and use of controlled blasting to minimize ground vibrations.

II. CONCLUSION

Mining practices caused serious environmental impacts related to water pollution, land degradation, loss of biodiversity, air pollution, increase in health related problems, noise pollution, vibration, land subsidence and landslides, surface and groundwater pollution is one of the significant impacts of mining activity. The government should aim at providing technical support to local mine stakeholders such as training in facilitation and management task to local stakeholders. New technology has to be developed that uses fewer chemicals during extraction and processing, and mine waste should regulate and turned into a non-harmful form before it is discharged to waste ponds. It has to be mandatory for all mining activities taking place, at both at large and small scale, to submit true environmental impact assessment report to get mine license. Government should strictly implement the act "The Environmental Protection Act, 1986" to all mine sector and should appoint inspection officer to check whether the mine holder following the act or not. At the outset, National Mineral Policy, 2019 is to be effectively followed by all the stakeholders of the society.

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