

## Environmental Regulations for Mining Projects in India

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### ABSTRACT

*There has been significant achievement in our country in bringing out enough legislative tools to address the problems of environmental pollution, forest and wild life protection. A Notification was published under Environment(Protection)Act1986 which has mandatory provision for mining projects to carry out study of Environmental Impact Assessment (EIA) and make Environmental Management Plan for obtaining Environmental clearance and to implement certain safeguards to address the adverse impacts. This EIA Notification 1994 includes mining project with lease area more than 5 ha to obtain Environmental Clearance from Central Government. As these are site-specific projects the mining projects are subjected to two tiers of clearance process, thus, a mining project can get first Site clearance and then environmental clearance after obtaining site clearance. Site clearance helps to know, in initial stage of investigation about the natural significance of the proposed area in terms of diversity, endemicity and status of the flora and fauna of the area and importance of the ecosystem there. In the environmental clearance process, a provision has been made to hold public hearing for mining projects involving lease area more than 25 ha. This helps the project and the authorities to know the views of the public and concerned citizens of the area about their perception regarding socio economic and environment impact of the project. The rules framed under Environmental (Protection) Act 1986, specify standard of Air, Water and noise parameter for the mining projects to comply. The individual project oriented EIA exercises often do not address the issues Under Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981, the Pollution Control Boards have powers to obtain information take samples and carry out analysis and power of entry and inspections). Provisions are also made to enable State Boards to prohibit use of stream or well for disposal of polluting matter. Central Government has been delegated with powers under Section 18 (2) of the Mines and Minerals Regulation and Development Act, 1957 with regard to conservation and systematic development of minerals and for the protection of environment for preventing or controlling any pollution which may be caused by prospecting or mining operations). The provisions provide to deal with the disposal or discharge of waste slime or tailing arising from any mining & metallurgical operations carried out in a mine. Direction may be issued to the owner of the mine to take measures for protection of the environment by preventing or controlling pollution. Under Section 18 of the MMRD Act, 1957, a Comprehensive account on environmental impact and management was made under the Mineral Conservation and Development Rules, 1988. The various provisions describe in detail the environmental protection measures in mines. Every holder of a prospecting license or a mining lease shall take all possible precautions for the protection of environment and control of pollution while conducting prospecting, mining, beneficiation or metallurgical operations in the area. In all such legislations more emphasis has been made to address impacts and to carry out mitigation measures or reclamation with reference to individual projects. For such mining projects located in a particular area or in clusters, the development may be subjected to EIA procedure on regional scales to assess impacts of multiple projects. A regional or sectoral EIA can reduce the time and effort required for project-specific EIAs in the same region by identifying issues, initiating baseline data collection, and assembling existing data in advance. In many cases, by eliminating need for the project-specific EIA can be fully avoided. There is need to frame such guidelines or enact legislation to achieve sustainable development*

### INTRODUCTION

India is endowed with variety of minerals which contribute enormously in the economic progress of the country. The mineral regions also contain rich natural resources like forests, wildlife and water

sources and if the mineral extraction is not properly and judiciously followed, there is likelihood that the natural balance may get disrupted. Already various regions in the country are facing water pollution, forest degeneration and wildlife extinction due to developmental and anthropogenic activities. Mining may magnify these problems and the natural food chain may get altered affecting the human life. The mining projects generate overburden and mine spoils with many toxic and un-

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healthy chemical elements. These pollutants can become air-borne or water-borne and can affect the surroundings and the human population in the vicinity. The mining projects require water for process and other purposes. The leachates from mine spoils, mine water and workshop effluents have certain quantities of toxic substances which can adversely impact the local environment. The ground water may get polluted because of leaching and percolation of mine water through discharge from tailings and the mining pits. The Heavy Earth Moving Machineries (HEMM) and equipments used in the mining projects and the transport vehicles generate high noise level and dust during various operations affecting the environment.

In most of the mining projects, monitoring mechanism is poorly developed. This results into helplessness on the side of the Project authorities to tackle any environmental problem because of the inadequacy of data collection and documentation of the environmental happenings. Lack of awareness about need for environmental protection and management and scarcity of available trained man-power to tackle with the issues related to environmental pollution and control. Non-reclamation of habitats and sites which have been degraded due to mining operations, choosing of unwanted forest species or plants and un-systematic plantation exercises without taking into consideration, quality of soil, gradient of the area and suitability of the species. Lack of aftercare and maintenance of the plantations and pollution control devices developed in the project area make the Project authorities also handicapped to accelerate the process of amelioration of the quality of environment and to check further degradation and pollution in the areas where efforts already have been put in. Allocation of insufficient budget for implementation of provisions of Environmental Management Plans (EMP) is also one of the constraints. In most of the projects, separate provision in budget for EMP is not maintained. There are other specific problems associated with the mining projects. The underground and opencast mining operations are known to contribute to air and water pollution. The water bodies and rivers flowing through these areas receive high level of siltation and pollution. Proper treatment of the effluents discharged from mines and beneficiation plants must ensure meeting the prescribed standard. Effort should be made to recycle the

liquid effluents for the process and other uses. The impact of various parameters of air and effluents should be regularly monitored and maintained at the level prescribed. Pumping of underground water may affect the recharge system of ground aquifers. For treatment of heavy metals in the effluents, present effluent treatment system in the mines need up gradation. Water quality monitoring of rivers in mining areas indicated that the river water has deteriorated and is only suitable for Wildlife and fisheries. BOD is the critical parameter. The treatment systems for discharges from underground mines and reclamation measures for mine spoil and tailings should be reviewed to incorporate new technological interventions.

The human diseases generally observed in mining areas are peptic diseases, Malaria and Dysentery and Gastroenteritis. This indicates that mining creates water quality impact affecting the health. Monitoring of ground water quality parameters is required in villages also to ensure that parameters are not higher than the prescribed limit.

Most of the mining areas generally contain good forest cover. The mining projects may have greater impact on flora and fauna of the area. Forest areas will go on decreasing, with increase in mining activity. The areas occupied by permanent structures like buildings, roads, workshops, office complex, dispensary, residential areas, schools and mining pits can not be made available for years for afforestation. Plantation by exotic species with certain unknown ecological impacts may change the micro ecological settings. Indigenous on the other hand shall generate long term environmental benefit in terms of biodiversity conservation and socio-economic acceptance. The impacts of mining in using agricultural land are shrinkage in crops areas and net crop yield, increase in population flux with greater demand of agriculture produce. It is likely that there may be conflicts between local inhabitants and Project authorities. To meet the local needs especially the food, the mining projects should adopt peripheral villages to introduce new socioeconomic and agricultural initiatives.

These impacts have attracted attention of environmental and mining experts and policy institutions. It is indicated that the ecological cost of environmentally unsound mining is far greater than it the economic benefit generated by mining.

These projects create varied range of impacts i.e., social, environmental, health, economic and political. The mitigation measures to ameliorate such impacts is cost prohibitive and in long run it becomes impossible. Most of the old mining areas of Raniganj-Asansole-Dhanbad region have not yet been restored. Keeping these aspects in view and gravity of the problem, all the countries have enacted legislations for eco-friendly mining. In India, provisions made towards environmental management of mining areas are discussed in the paper in following paragraphs.

## THE LEGISLATIONS

### Environmental Impact Assessment Notification, 1994

The above notification was made under sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with clause (d) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, The requirements and procedure for seeking environmental clearance for mining projects are detailed below :

Any person who desires to undertake any new project in any part of India or the expansion or modernization of any existing industry or project listed in the Schedule-I shall submit an application to the Secretary, Ministry of Environment and Forests, New Delhi.

The application shall be made in the proforma specified in Schedule-II of this notification and shall be accompanied by a project report which shall, inter- alia, include an Environmental Impact Assessment Report, Environment Management Plan and details of public hearing as specified in Schedule-IV prepared in accordance with the guidelines issued by the Central Government in the Ministry of Environment and Forests from time to time. Public Hearing is not required in respect of) mining projects (major minerals) with lease area up to twenty five hectares

Being site specific, the mining projects are subjected to two tier clearance procedures The project authorities will intimate the location of the project site to the Central Government in the Ministry of Environment and Forests while initiating any investigation and surveys. The Central Government in the Ministry of Environment and

Forests will convey a decision regarding suitability or otherwise of the proposed site within a maximum period of thirty days. The said site clearance shall be granted for a sanctioned capacity and shall be valid for a period of five years for commencing the construction, operation or mining. The mining projects (major minerals) with leases more than 5 hectares are only covered under the notification. The following parameters are important to decide clearance cases.

- Alternate sites examined and the reasons for selecting the proposed site: Does the site conform to stipulated land use as per local land use plan:
- Objectives of the project, Land Requirement: Agriculture Land: Forest land and Density of vegetation. Other (specify): Land use in the Catchment within 10 Kms radius of the proposed site: Topography of the area indicating gradient, aspects and altitude: Erodibility classification of the proposed land:
- Pollution sources existing in 10 km radius and their impact on quality of air, water and land:
- Distance of the nearest National Park/ Sanctuary/Biosphere Reserve/Monuments/ heritage site/Reserve Forest: 8Rehabilitation plan for quarries/borrow areas: 9Green belt plan: Compensatory afforestation plan:
- Climate and Air Quality: Windrose at site: Max/ Min/Mean annual temperature: Frequency of inversion: Frequency of cyclones/tornadoes/ cloud burst: Ambient air quality data: Nature & concentration of emission of SPM, Gas (CO, CO<sub>2</sub>, NOx, CH<sub>4</sub> etc.) from the project:
- Water balance at site: Lean season water availability; Water Requirement: Source to be tapped with competing users (River, Lake, Ground, Public supply): Water quality: Changes observed in quality and quantity of groundwater in the last years and present charging and extraction details: (i) Quantum of waste water to be released with treatment details:
- Quantum of quality of water in the receiving body before and after disposal of solid wastes: Quantum of waste water to be released on land and type of land:
- Solid wastes: Nature and quantity of solid wastes generated Solid waste disposal method:

- Noise and Vibrations: Sources of Noise and Vibrations: Ambient noise level: Noise and Vibration control measures proposed:
- Subsidence problem, if any, with control measures:
- Power requirement indicating source of supply: Complete environmental details to be furnished separately, if captive power unit proposed:
- Peak labour force to be deployed giving details of: Endemic health problems in the area due to waste water/air/soil borne diseases: Health care system existing and proposed: (a) Number of villages and population to be displaced:
- Detailed Feasibility Report: Rehabilitation Master Plan: Risk Assessment Report and Disaster Management Plan:
- Environmental Impact Assessment; Environment Management Plan: and duly filled in questionnaire Details of Environmental Management Cell:

## THE GUIDELINES

The environmental management of mining operations becomes a part of the total project once a systematic plan is prepared and made as a part of total project exercise. The environmental guidelines for mining projects have been published by the Ministry of Environment & Forests. These guidelines help project to identify related impact and address appropriately in the EIA and EMPS of the mining projects. These guidelines are applicable to all types of mines as environmental impacts are broadly similar in all cases except a few individual specific impacts. An extract from the guidelines addressing the major environmental impacts and their mitigation plans.

## WATER POLLUTION AND CHANGES IN HYDROLOGICAL REGIME

### *Liquid Effluents:*

Liquid effluents include Mine water, Spent water from handling plants, dust extraction and dust suppression; Effluents from preparation and beneficiation plants, and Leachates/wash offs from waste/tailings dumps.

Management options are the discharge of toxic and objectionable effluents into surface water bodies, ground water aquifers or usable lands to a minimum, Recycling of waste water, Effluents be

treated to conform to the standard and utilised plantations raised to stabilize the mine waste dumps.

### *Acid Mine Drainage*

Acid Mine drainage interacts with the water table, aquifer, perched water body and has low pH and high levels of Sulphates, iron and total dissolved solids. These deplete oxygen level in water, increase toxicity by rendering heavy metals soluble and create corrosion problems.

Modified mining methods; sealing of mine or part after closure; surface reclamation; water diversion; and control of ground water flow system by well fields or other methods to prevent the exposure of ground water to sulphides in a mine coating sources with gels can be adopted to prevent formation of acid mine drainage. To control the acid mine drainage, the techniques include deep well injection, subsurface dams and grout curtains; To dilute acid mine drainage to an acceptable effluent quality; and Waste water treatment method for neutralisation and removal of dissolved solids, include lime or limestone treatment accompanied by aeration or oxidation process to convert ferrous ion to ferric ion, neutralisation with soda ash, caustic soda and anhydrous ammonia reverse osmosis; iron exchange; electro-dialysis evaporation; ozone oxidation; desulfating; sulfide iron removal ; microbiological control; and permanent iron removal.

The coal mining projects of North Eastern Region may have to search for such technology for acid mine water treatment for production of Human life and natural ecosystems.

### *Impact on Surface Water Regime*

Diversion of streams traversing the proposed mining area will have to take note of the conditions in the catchment and downstream areas, and downstream users and flora and fauna. Apart from providing adequate channel capacity of the diversion section with due regard to maximum flood intensity, area of command catchment etc., it would also be necessary to consider the bed slope and other hydraulic parameters. Diversion should be determined on the basis of surface topography hydrological aspects, drainage pattern etc. Influx of fines and wastes (solid) from mining operations may lead to excessive aggradations of stream courses, leading to several adverse effects including

over spilling and creating artificial barriers in the channel-such situations need to be avoided. Withdrawal of surface water for mining/colony requirements upstream may reduce the flow and adversely affect the pollution absorption/dilution capacity of the stream. Efforts should be made to obtain water supplies from a separate source.

### **Impact on Ground Water Regime**

Artificial lowering of the ground water table and depletion of aquifers that are tapped by mining operations may have adverse effects on wells, tanks and even effluent reaches of streams/rivers; drawdown in pump wells in alluvial/sedimentary areas (coal/sand mining operations); hydrodynamic conditions of river/underground recharge basins; volume of subsurface discharge to rivers, depending on the hydro geological conditions and adverse hydro chemical alterations by chemical pollution from mining wastes. Considering the local geological, geomorphologic and hydro geological setting, various measures may be incorporated into the overall plan for mining operations to minimise the adverse effects on the water regimes. Amongst such steps are:- The control measures may include settling ponds and coagulant aids prior to discharge of wastes to water bodies, to reduce influx of fines, sealing of shafts against aquifer zones, filling up of mined/Stopped zones, controlled subsidence and selection of tailings/waste disposal sites away from water bodies etc

## **SOLID WASTE MANAGEMENT**

### **Site Selection**

The disposal sites should be located on a secure and impervious base with minimum leaching effects due to natural precipitation far from natural water courses, shallow aquifers etc. wastes with abnormally high concentrations of undesirable reactive elements should be disposed off in sanitary landfills. The height of the dump should not exceed the mature tree top level in the area. The type and characteristics of the waste rock is also important in determining the height of the dump. The dump must be properly graded and terraced with contour drainage as necessary accompanied by stabilization using proper vegetation, after levelling and providing soil cover to utilize the land profitably. The wastes may also be used as road metal or construction aggregates, after crushing to proper size.

### **Tailing disposal**

Tailing disposal may be done on land in tailing dams, disposal in deep waters (sea) and dry land disposal. Tailing may also be used for filling in mine workings. Land disposal of tailings should be preferred. Tailing dams should be designed to provide for storm water runoff. Tailings may be discharged into the sea after ensuring that the discharge point is sufficiently deep and the quality of effluents is within the limits of tolerance of aquatic life/planktons. Tailings disposal in rich forests, sanctuaries and reservoir catchments should be avoided. The hill slopes in the foreshores and catchments of the tailing dams require dense afforestation with contour trenching above the high flood level, to preclude the discharge of monsoon water into the tailing reservoir and agitation of the tailings. The borrow areas around the tailings dams also need to be revegetated. The following restrictive measures are necessary for the use of such disposal sites :i) Tailings with significant quantities of releasable substances, such as, ammonia, arsenic, asbestos (Chrysolite and/or amphibole), cadmium, copper, cyanide, lead, mercury, nickel, zinc, radioactive material, and toxic compounds and substances that tend to bio-accumulate and are harmful to all forms of life and flora may be disposed only if the dam is impervious and the decant serving the tailings area is directed to 'downstream' facility (preferably on land) for any required chemical and/or physical treatment. Tailings containing slime fractions should not be deposited in land water sites without provisions for effective desliming. The tailing area should be revegetated before being abandoned. Dry land tailing pond with least permeability should be chosen to preclude contamination of ground water. The site should have minimum storm water catchment area arrangements for the storm water drainage should also be provided. Peripheral plantations should be raised as wind belts to minimise the dry tailings being airborne. Once a tailing dam is abandoned it should be revegetated with suitable species to bring it into harmony with the environment.

## **AIR POLLUTION**

Air pollution components generated by mining and associated activities are Gaseous pollutants (Sulphur dioxide, Nitrogen oxides, Carbon monoxide and Hydrocarbons etc.) and Suspended

Particulate Matter (Silica, Fluorides, Asbestos and metallic Mineral Fumes etc.) are released Due to mining operations and beneficiation activities. Prevention and Control measures may include preventing dust from being air borne; transport equipment (trucks and railway wagons etc.) should be leak proof and properly covered. Alternatively, suitable chemicals may be sprayed on the top to prevent such effects. Adequate dust suppression and extraction facilities must be provided at the coal/ore handling plants, crushing and screening units. The haul roads in the open cast mines/quarries need to be adequately water sprayed. Roadside plantation of dense belts of trees serves as dust arresters (one hectare of trees can arrest 30-50 tones of dust). To minimise dust pollution, measures such as adoption of hoods at transfer points, proper design of chutes, vulcanizing of conveyor belt joints, under belt cleaning devices, apart from installation of dust suppression and/or dust extraction systems for conveyors should be introduced. In the case of surface mines and allied operational units, dust concentration standards should be specified. Residential and sensitive points should be as far away as possible so as to maintain air quality parameters in these areas within the limit prescribed.

## **NOISE AND VIBRATION PROBLEMS**

### ***Source and control measures***

Mining and mineral processing activities generate obnoxious levels of noise and vibration. Blasting, drilling, underground mining equipment and ventilation fans are sources of noise and vibration in the underground mines. Heavy earth moving machinery, drills, dumpers, material handling, crushing and cleaning equipment are prominent above ground sources. In beneficiation plants noise and vibration are primarily occupational health problems. Choosing machinery and equipment suitably, by proper mounting of equipment and ventilation systems and by providing noise insulating enclosures or padding may reduce the impact. Residential colonies and township should be located reasonably away from the mining premises. Boundary walls (baffle walls), waste banks and dense belt of trees should be erected to act as acoustics barriers. A 50 m. wide belt of trees of different heights is especially useful to act as a noise attenuator in the mining areas. In existing mines, it is suggested that a noise survey should

be conducted by an expert to identify sources of excessive noise and to design and implement appropriate control measures. In new mines anticipatory measures for noise reduction should be incorporated at planning stage in consultation with expert.

Ground vibrations caused by blasting operations, subsidence due to mining operations, deployment of mobile equipment, rock bursts and rock bumps May lead to damages to structurally unsound buildings and can also be a cause of annoyance to human beings. Control of ground movement due to vibration can be achieved by avoiding over-charging, use of delays and improved blasting technology and taking in view vibration transmission properties of geological formations and terrain stability (tectonism, seismicity etc.) Norms for permissible limits of vibration for various zones should be prescribed.

## **SUBSIDENCE PROBLEMS**

Surface subsidence causes extensive degradation of the natural environment and damages to man made structures. It affects the ground water regime, surface drainage pattern and usable land. Highways, buildings, bridges, water and gas mains may also be sheared, twisted or broken by strains and slope changes. The alleviation of subsidence damage can be undertaken either by precautionary measures on surface to protect installations, or by appropriate modification of the mining methods so as to minimise deformation of the surface.

## **HUMAN SETTLEMENT PROBLEMS**

The mining activities are mostly confined to remote areas which are sparsely populated yet measures for rehabilitation of the people displaced by the mining operations should be taken. All care should be taken to ensure that the traditional life style of the people is not disturbed and populations get maximum benefit accruing due to development of the mineral deposit. Facilities for health care, education, recreation, employment etc. should be provided. Since these are located in remote areas the township is essential component of mining activities. These townships shall be properly planned according to normal town planning practices and should not be allowed to grow indiscriminately. Adequate infrastructure should be developed so as to avoid straining infrastructural facilities of the nearby settlements. The township

shall be provided with safe drinking water supply and sanitary system for collection, treatment and disposal of sewage and garbage. Possibilities of reuse of treated effluent water for sewage farming and pisciculture shall be seriously considered.

### **APPLICATION OF FOREST (CONSERVATION) ACT 1980**

The Forest (Conservation) Act, 1980 was notified by the central Government which came in to force from October 25, 1980. As per the provisions of this Act, prior approval is required from the Central Government is essential for diversion of forest lands for the mining (non-forestry) purposes. The objective of the Act is to regulate the indiscriminate diversion of forest lands for non forestry uses and to maintain a logical balance between the developmental needs of the country and the conservation of natural heritage. The, guidelines have been issued under the Act from time to time, to simplify the procedures, to cut down delays and to make the Act more user friendly. Further amendments to the act and Rules under this Act have been framed and notified in the year 1981,1988,1992, 2003 and 2004 by the Ministry of Environment and Forests. The rate of diversion of forest lands for non forestry purposes has come down from about 1.43 lakh ha. Per annum to around 15000 ha per annum after the year 1980. Generally forest diversion is allowed for Drinking water projects, Irrigation projects, Transmission lines, Railway lines, Roads, Power projects, Defense related projects, Mining etc. To recover the ecological loss, the mitigation measures like raising compensatory afforestation, catchment area treatment plan, wildlife habitat improvement plan, rehabilitation plan etc. are being implemented.

### **MONITORING ACTIVITIES**

The Ministry of Environment and Forests through its six regional offices, Central Pollution control Board and its Zonal offices, State pollution control boards carry out monitoring to ensure implementation of Environmental safeguards including implementation of schemes on pollution prevention and control by mining projects. Mining activities attract the provisions of Water (prevention and control of Pollution) Act 1974 and Air (Prevention and control of Pollution) Act, 1981,

and are regulated by concerned state Boards. The conditions of Forest (Conservation) Act, 1980 are being monitored by regional offices of the ministry. An authority named as "Compensatory Afforestation Management and Planning Authority (CAMPA)" is being constituted at the national level to make the monitoring more effective. Forest conservation division of the Ministry of Environment & Forests monitor the movement of proposals at various stages and the compliance of the conditions stipulated in the forestry clearances along with regional offices.

### **RECOMMENDATION**

Regular training and awareness programmes about existing Rules, Regulations and Guidelines relating to mining and environment and compliance should be given to the officers at all levels right from Head of department to the field level officers of mining, environment and forests departments. Heads of organisations of the mining projects must know about the environmental action plans and their achievements. The EIA studies may be more effective if done at regional levels than individual one in case of mining clusters like Coal, Iron, chromites mining etc. This may help addressing the cumulative and inter boundary impacts. At least quarterly meetings should be taken by him to review the progress and to direct the concerned accordingly. This helps to execute the project at desired speed and target. Adequate fund provision must be made for implementing the programmes relating to environmental management in the project area and in no case, the funds should become a limiting factor. The sooner the environmental problem is ameliorated, the lesser the investment is needed from the Project for future reclamation.. There is a strong need to have an over-all screening and reviewing of the Acts and Rules relating to mineral industry. Opening up new areas without exhausting the mineral resources available in existing mining projects or without reclaiming the earlier workings should not be permitted. To avoid investment in new projects which is enormous the existing mining projects could be strengthened, modernised with new machinery and with an efficient new extraction procedures. The production in existing mines can be achieved at a significantly lesser amount compared to heavy investment in new projects. The exhausted one can be taken for full reclamation and land can be converted into a better land use more like a natural eco-system.