

# Environmental Impact Assessment of Mining at Khursipar Iron Ore Mine (MH)

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**Abstract**— Maharashtra is one of the largest producer of IRON And STEEL materials in the country. MSMC's Khursipar Iron Ore Mine producing mainly Titano-Magnetite ore. The iron ore deposit of Khursipar is very important since it contains valuable mineral, vanadium which can be economically extracted. This deposit can be exploited for production of vanadium metal. This paper reports the find out the socio-economic and environmental impacts of mining in Amgaon tehsil, Gondia, Maharashtra. The current production capacity of iron ore in Khursipar (Ambetalav) is around 180 Mt. Opencast Mining, Height of the Bench is 3.0 M. Width of the bench is 15 to 20 M and Angle of Slope is not exceeding 60°. Mining is widely regarded as having adverse effects on environment. Some of these effects include impact on wildlife, socio-economic impact and contamination of groundwater by chemical from the mining process in open-pit mining. As such, a repeatable process effects primarily tends to destroys them early. It is very necessary to study of the Environmental Impact Assessment (EIA) of the iron ore mining activity on the future development and management of the natural environment and resources of Gondia district. Normally, iron ore mining in India is done by opencast mining method and on this basis of mining methods, the mining can be broadly classified into two categories, i.e., manually and machinery.

**Key words:** Mining Activities Impact, Local Citizen, Iron Ore Mining, Gondia District, Open Cast Mining

## I. INTRODUCTION

Maharashtra is one of the largest producer of IRON And STEEL materials in the country. Maharashtra State Mining Corporation Ltd Nagpur has proposed for mining of iron for 9.32 hectare at Village Khursipar, Tehsil Amgaon and District Gondia (Maharashtra). As per EIA Notification this project falls under Category "B" (mining projects which having an area less than 50 hectares). - as the lease area is 9.32 ha. Therefore this project come under category-B projects which should be considered by Maharashtra State Mining Corporation Ltd Nagpur, constituted with the approval of MoEF. MSMC's Khursipar Iron Ore Mine producing mainly Titano-Magnetite ore. The iron ore deposit of Khursipar is very important since it contains valuable mineral, vanadium which can be economically extracted. This deposit can be exploited for production of vanadium metal. This paper reports the find out the socio-economic and environmental impacts of mining in Amgaon tehsil, Gondia, Maharashtra. The current production capacity of iron ore in Khursipar (Ambetalav) is around 180 Mt. Opencast Mining, Height of the Bench is 3.0 M. Width of the bench is 15 to 20 M and Angle of Slope is not exceeding 60°. Mining is widely regarded as having adverse effects on environment.

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chemical from the mining process in open-pit mining. As such, a repeatable process effects primarily tends to destroys them early. It is very necessary to study of the Environmental Impact Assessment (EIA) of the iron ore mining activity on the future development and management of the natural environment and resources of Gondia district. Normally, opencast method is use for iron ore mining and on the basis of mining methods, the mining can be broadly divided into two categories, i.e., manually and machinery.

### A. Lease Status

The mining lease area of 9.32 Hectares in village Khursipar Tehsil Amgaon District Gondia for mining of iron was renewed in 2016 upto 2036.

### B. Project Area

Out of the total mine lease area of 9.32 ha; 4.30 ha is extraction land, 5.02 ha is Forest land. No agriculture land is involved. Mining shall be carried out for a targeted production of 00.262 Million Tonnes per annum of iron and titanium by opencast mechanized method without involving blasting.

### C. Geology

This deposit's are of igneous origin. The rock in which the magnetite ore bodies occur belong to the early Precambrian Amgaon Group. The deposit comprises several magnetite ore bodies associated with metapyroxenite and amphibolites. The massive ore forms the peaks of the ridges and the float ore is found on the slopes of the hillocks. The outcrops of magnetite are weathered and fractured and form a loose mass. The magnetite is brown, bluish to dark black in colour and coarsely crystalline. Banded ore could be seen in fresh drill core. Banded ore is fine grained and mostly greyish in colour. This banded feature is due to alternate layers of magnetite and basic rocks. Major part of the lease area is covered with soil mantle, except, for the sporadic small outcrops and Titaniferous-Magnetite / basic rocks exposed on the elongated knolls/mounds. The mound slopes are covered with thin mantle of Magnetite and basic rocks screen. As the area mostly covered, the geological mapping of the area, along with some traverses in the surrounding areas, assumed prime importance in understanding the Geology of the area.

The rocks of the lease area include granites and metabasic rocks. The granite occur in the eastern part of the area occupying the flat opened ground. It ranges from granodiorite to granite, which are medium to coarse grained. The metabasic rocks of the area form the most conspicuous lithological units. Regionally this occurs as dykes emplaced along a narrow N-S rectangular zone marking the contact between the granite in the east and granite gneisses to the west. These rocks have special significance in the lease area, as these carry/ contain Titano-Magnetite in considerable amount.

#### D. Mining

It is open cast working mine and manual working is adopted in the mine. And it is proposed to have the same method in future also.

##### 1) Opencast Mining

- Height of the Bench : 3.0 M.
- Width of the bench : 15 to 20 M.
- Angle of Slope : not exceeding 60°

The Titanomagnetite ore is soft in nature and does not require any Drilling and Blasting. The mining operation will be carried out by digging and ROM will be sorted and screened to meet the specification.

Sub-grade mineral/rejects whatsoever generated will be stacked in the western side of the lease area.

#### E. Location

The mining lease area under reference is situated Tehsil-Amgaon District Gondia (Maharashtra). Existing road facilities are very close to the site and are sufficient; hence there is no proposal for making any new road or rail connectivity. The area forms part of the region covering rocks of the Precambrian Amgaon Group and the overlying Dongargarh super group. The area is included in Survey of India Toposheet 64 C/3 between Latitudes: 21°22'35."N and 21°22'59.109"N, Longitudes: 80°17'25.8"E and 80°17'36.824"E respectively comprise granite gneisses and granite.

#### F. Communication

Mine is well connected by village road passing through the mine site that merges with Gondia district. The Nearest Railway station is Gondia at a Distance 25 Km in SE direction.

Identification of all potential environmental impacts due to project is an essential step of Environmental impact Assessment. These are critically examined and major impacts (both beneficial & adverse) are further studied. The construction, commissioning and expansion of any type of developmental projects have significant influence on the existing physical, biological and social components of environment. Impacts on biodiversity, air pollution, water pollution, waste management and social issues are significant in mining projects. The nature and characteristics of impacts are required to be taken into consideration while evaluating the magnitude of impacts.

Open cast mines, which are more, preferred now for rapid increase is mineral production and safety reasons, the significant impacts are on land use, drainage, air quality, ecology, noise etc.

Allied operations such as transport of materials, operation of workshop, drilling, blasting etc. affect the air, water and noise environment. Clearance of natural vegetation adversely affects the flora and fauna of the areas due to changed environment. Mining activities are normally carried out over a long period (about 30yrs or more. This also encourages downstream industrial development in the area which adds to environmental degradation. The identified significant impacts require detailed analysis for decision-making and formulating adequate mitigation measures. The various anticipated impacts and mitigation measures are discussed in this paper.

## II. LAND ENVIRONMENT

### A. Geology

The Central Indian Tectonic Zone (CITZ) is a significant continental scale tectonic zone of Proterozoic age. It divides the Indian shield into two tectono magmatic provinces, the northern crustal province comprising Bundelkhand craton and the southern peninsular crustal province comprising Bastar, Dharwar and eastern Singhbhum.

The Central Indian Suture zone (Yedekar et al., 2003, 1990) is a major ENEWSW trending ductile mylonite zone separating the Bundelkhand and Bastar cratons. It is almost 500 km in length and the width ranges from 0.02 to 4 kmLocal geology.

The area forms part of the region covering rocks of the Precambrian Amgaon Group and the overlying Dongargarh super group. The area is included in Survey of India Toposheet 64 C/3 between Latitudes: 21°22'35."N and 21°22'59.109"N, Longitudes: 80°17'25.8"E and 80°17'36.824"E respectively comprise granite gneisses and granite.

These are traversed by metabasies occurring as dykes, emplaced along a narrow rectilinear zone, marking the contact between the granite gneisses and granites. These dykes are of special interest due to the association of titaniferous magnetite.

Major part of the lease area is covered with soil mantle, except for the sporadic small outcrops and titaniferous magnetite/basic rocks exposed on the elongated knolls/mounds. The mound slopes are covered with thin mantle of magnetite and basic rock screen. As the area is mostly covered, the geological mapping of the area, along some traverses in the surrounding areas, assumed prime importance in understanding the geology of the area. The lease area was topographically surveyed and geologically mapped on 1: 1000 scale, with topographic contours at 1.0 m interval.

The rocks of the lease area include granites and Meta basic rocks. The granites occur in the eastern part of the area occupying the flat open ground. It ranges from granodiorite to granite which is medium to coarse grained. The metabasic rocks of the area form the most conspicuous lithological units. Regionally these occur as dykes emplaced along a narrow N-S rectilinear zone marking the contact between the granite in the east and granite gneisses to the west. These rocks have special significance in the lease area, as these carry/contain titanomagnetite in considerable amount.

The meta-basic dyke rocks comprise meta gabbros and its igneous-facies including diorite, dolerite, amphibolite, anorthositic rock etc. these are mainly melanocratic with some showing ophitic texture, megascopically thick clots of dark ferromagnesium porphyro blasts set in light coloured plagioclase ground mass. Within the dyke zone, there seems to be some distinctions and distribution. While in the eastern part the dominant rock unit comprises floual epidiorite, the gabbro with amphibolites dominates the western part. The titanomagnetite rich zone associate with gabbroic rock is more or less sandwiched between these two rock units. The ore bearing host rock is essentially gabbroic in composition broadly comprising plagioclase feldspar, hornblende, penninite, biotite, opaque minerals and minor quartz, apatite, actionolite coexisting with discrete grains of ilmenite. Some

hematite and minor or traces of sulphides and rutile. No vanadium mineral has been detected, but vanadium is reported to occur structurally with magnetite.

### B. Topography

The area is physiographically gently undulating developed on granitic gneiss and granite and is covered by alluvium. Then it is traversed by metabasic dykes. The titanomagnetite rich zone associated with gabbroic rock. The field evidence indicates that they occur as lenses or layers of massive Fe-Ti oxide and that are in sharp contact with their host rocks. The ore zone varies in thickness from about 5 to 40m. Mining lease area comprises of undulating plain where the iron ore are marked in form of undulating uplifted portion sloping towards west. The maximum elevation in the area is 361 MRL and minimum elevation in the lease area is 349 MRL. Major part of the lease area falls under "Jhudapi Jungle" category except (A) New Khasara No. 165 (641 Ac) and (B) 132 (4.38 Ac). Thus the mining activities have been proposed in these two sectors, viz Sector „A“ (Northern block) and Sector „B“ (Southern block). These two sectors are also separated by Dahegaon – Khursipar village road and also a stretch of 150m long covered ground (gut no 137 which falls under forest land). In Sector-B, the zone covers two smaller mounds, covering a strike length of about 180m and has thickness of 12m to 15m. Mining operations are confined to these two sectors only.

No major stream or channel is flowing in and around the lease area. However there are two small ponds 250m away in the south eastern side and 520m away in the western side of lease. The vegetation is scarce in the area and most of the surroundings are covered by farms comprising of soil.

## III. MITIGATION MEASURES

### A. Plan for restoration/rehabilitation of mined-out area

There is no issue of restoration & rehabilitation of mined out area. There is no human settlement in the Mine Lease area. Mining operations will thus not disturb/relocate any village or settlement. The nearest settlement is at 600m away in south west direction. Towards the end of life of mine mined out area will be backfilled and water body will be developed later on. Green belt will be developed along the water body.

### B. Technological measures to prevent soil erosion from core and buffer Zones and control and conserve runoff from various locations

- 1) Plantation of grass on bench surfaces to prevent soil erosion.
- 2) Plantation has been carried out at office premises and along the road
- 3) Plantation of grass is proposed on waste dumps
- 4) Drains ( ) will be constructed around waste dumps to guide runoff water during rain from dumps to the lower levels of broken up area.
- 5) There is 1-2m soil present in the area. It is good quality soil and will be stacked separately for plantation purpose.
- 6) The species like Nilgiri (Eucalyptus), Ashok (Saraca asoca), Gulmohar (Delonix regia), Mango (Mangifera indica), Amla (Phyllanthus emblica) and Sal (Tectona grandis Linn) (Sakher i.e Shorea robusta) will be planted. Preference will be given to local species.

- 7) In order to increase survival rate of plants the planted area will be protected with the help of enclosures and proper watering, soil toppings added. There is tube well present outside lease area. Water required for plantation will be drawn from here. Besides pit get accumulated with rain water during monsoon which will be utilised for plantation.

### C. Plantation/afforestation of local varieties of plants

- Tolerance to specific conditions or alternatively wide adaptability to eco-physiological conditions;
- Rapid growth;
- Capacity to endure water stress and climate extremes after initial establishment;
- Differences in height and growth habits;
- Pleasing appearances; and
- Providing shade.

Additional factors which will be considered while selecting species looking into industrial environment include:

- Fast growing;
- Thick canopy cover;
- Perennial and evergreen;
- Large leaf area index;
- High sink potential;
- Efficient in absorbing pollutants without significantly affecting their growth; and
- Local Indigenous species.

## IV. AIR ENVIRONMENT

### A. Climatic Conditions

During the monsoon season the wind blow mostly from directions between south-west and northwest. In the period October to February, the winds are mainly northerly to north-east in the morning and north-easterly to easterly in the afternoon.

The minimum speed of wind is observed in the month of December that is 2 Km/Hrs. and maximum speed is observed in the rains. Predominant wind direction is North-East.

- Average Humidity – 62% (ranging 43-83%)
- Temperature – 46.0 Degrees (max) 6.0 Degrees (min)
- Highest rainfall in district ranges from 1300 to 1500mm.
- Average rainfall – 1200mm

## V. MITIGATION MEASURES

### A. Measures to reduce the emissions of pollutants during mining, loading, unloading, transportation, drilling, blasting, crushing etc. to maintain the air quality

As it is a small mine having capacity of 35000 TPA (117 Te per day) and ore being soft in nature, mining is carried out by manual open cast method. And if in case hard strata is found in near future wet manual drilling will be adopted. No machinery is proposed in the working. Extent of Air pollution will be minimal. The dust emissions are likely to be confined to the mine premises only. The tractor/trucks movement will cause emission of particulate matter. However, this will be fugitive in nature and will be restricted to the proximity of the haul road only. Sprinkling of water on haul roads, waste dumps etc. are regularly done and the mine workers are

provided with dust masks. Iron Ore obtained from the area is sold without beneficiation after screening and sizing.

The present air quality in the area is clean and not polluted as there is no active industry.

Predominant wind direction is North-East. The machinery required does not produce any harmful effects such as noise, vibrations, pollution etc. Hence quality of air will not be affected.

**B. Adoption scientific mining methods to reduce dust emission from point and line source**

- Dust generation shall be reduced by using sharp teeth of shovels;
- Wet manual drilling will be adopted if hard strata are found
- Sprinkling of water, in the pit at loading faces, haul roads and on dumps, will be religiously carried out, this will help in reducing considerable dust pollution;
- Number of tankers/ trips will be increased depending upon the actual requirement.
- The treated mine water (rain water stored in the pit) and water from bore well present outside lease area can be utilized for dust suppression in and around mine areas;
- Regular maintenance of vehicles shall be carried out in order to Control emissions
- All the trucks will be covered by tarpaulin to check any spillage of iron ore
- Monitoring the quality of air will be done at regular interval.
- Workers will be provided with the dust mask during working hours.
- Health of the workers will be periodically checked as to know the health status of workers.
- Cabins for shovel and dumpers and dust masks to workmen shall be provided;
- Advantage of wind direction and meteorology should be considered while Planning, so that pollutants, which cannot be fully suppressed by engineering Technique, will be prevented from reaching the residential areas; and
- Regular cleaning and removal of spillage Iron ore if any from the roads will be done regularly.

**C. Planned Green Belt Development**

- Dense plantation shall be carried in and around the mine lease, which would also help in combating air pollution;
- Plantation of grass on dumps is planned to temporary stabilize the dumps
- Comprehensive green belt on and around overburden dumps has to be carried out to reduce the fugitive dust emissions in order to create clean and healthy environment;

**D. Water Environment**

The mining lease area comprises of undulated topography where the iron (titanomagnetite) exposures are marked in form of undulated uplifted portion sloping towards all directions. No major stream or channel is flowing in and around the lease area. There are two small ponds 270m away in the south east side and 560m away in the western side of lease. There is no water course in the lease block. Area experiences moderate rainfall.

Mine is being worked by manual open cast Mining method. Proposed production levels are very low. Iron Ore obtained from the area is sold without beneficiation after screening and sizing. Hence No processing of mineral is carried out except manual sorting. Water is required in the mine for dust suppression, plantation and other domestic purposes.

Total water requirement for the project is 13000 L/D sourced from nearby bore well/ tube well. Breakup of the same is given here:

Sr. no	Purpose Requirement	(LD)
1	Drinking and other	1000lt
2	Dust Suppression	10000lt
3	Plantation	2000 lit
Total		13000 lit

Table 1: Water Purpose Requirement



Fig. 1: Pumping of Mine Water

**VI. MITIGATION MEASURES**

**A. Measures to minimize contamination of surface and groundwater**

- Workings will be on the surface only (at very shallow depth) and will not disturb the quality of ground water.
- Rainwater harvesting structures like garland drains; will be constructed at various places in the mines to channelize maximum quantity of water into the pit. Garland drains will have size of 0.5m x 0.5m. This will avoid surface run off and hence contamination of nearby ponds. Water accumulated in the pit is removed by using motors. Diesel pumps of 5 to 10 HP will be deployed for dewatering of pits.
- Dumps will be stabilized by growing grasses. Retaining walls of adequate dimensions will be provided along the boundary of dumps within the mine to prevent wash off

from dumps. This will help in preventing contamination; and

- The mine water (rain water getting stored in the pit) is being regularly tested for presence of any undesirable elements and appropriate measures will be taken in case any element is found exceeding the limits prescribed by CPCB;
- The water table is found to be 26 meters from surface during monsoon period and recedes to a level of 30 meters from surface in dry months. This information was collected from local people.
- The mine will not intersect groundwater table. Regular monitoring of water levels and quality in the existing open wells and bore wells in the vicinity will be carried out
- Massive afforestation program will be carried out to improve the quality of soil and its water absorbing capacity. This may improve ground water resources.

## VII. NOISE ENVIRONMENT MITIGATION MEASURES

### A. Measures for noise abatement including point source and line

It was stated in mining plan that mine being small and ore being soft, mining operation are too small and manual (Non - Mechanized), may not generate noise level in noticeable quantity, however following Noise Control Measures are followed

- Blasting is totally avoided; instead rock breakers (jack hammer) will be used. Wet manual drilling will be adopted
- Breaking will be carried out during favorable atmospheric conditions and less human activity timings;
- Tools required do not produce any harmful effects such as noise, vibrations, pollution etc.
- Scheduled maintenance of vehicles will be carried out to minimize noise.
- Greenbelts around infrastructure site and service building area.
- A thick tree belt will be provided in phased manner around the periphery of the mine to attenuate noise;
- Trees will be planted on both sides of haul roads.
- It is proposed monitoring of noise level regularly.
- Ear plugs will be provided to workers.

## VIII. BIOLOGICAL ENVIRONMENT MITIGATION MEASURES

### A. Measures to compensate the loss of forest coverage

Vegetation cover in the total lease area is very sparse. Out of total lease area (9.32Ha), 4.95Ha is a forest land. Lessee has applied for forest clearance. No work is carried out in the forest land.

### B. Regeneration of rare and endangered plants of economic importance including medicinal plants

It is proposed to plant various local varieties including plants with medicinal importance like Amla, Nilgiri etc

### C. Measures for protection and conservation of wildlife species Green belt and its raising schedule

- In order to increase survival rate of plants the planted area will be protected with the help of enclosures and

proper watering, soil toppings added; manure will be added to this soil. Their growth will also be monitored with the help of forest department.

- There is tube well present outside lease area. Water required for plantation will be drawn from here. Besides pit get accumulated with rain water during monsoon which will be utilised for plantation.
- There is 1-2m soil present in the area. It is good quality soil and will be stacked separately for plantation purpose.

### D. Progressive afforestation in overburden, reclaimed mined out areas

Plantation will be done on waste dumps and on the undisturbed area in the eastern side of northern block. The matured mining pit area shall be used for backfilling and water body will be developed later on. Plantation also will be carried out along the water body. Life of the mine is 7 years there will be one complete five yearly periods and one part two yearly periods.

## IX. SOCIO-ECONOMIC AND HEALTH ENVIRONMENT MITIGATION MEASURES

### A. Rehabilitation and resettlement of land oustees and displaced people

There is very little chance of mining lease area getting rehabilitated with any (remnant) activities. Part of the land is Government revenue land.

### B. Compensation for loss of land and crops

Some part of the land has been purchased while some part is acquired through compensation.

Cost per year of compensation comes to Rs 40800/- and it may vary.

### C. Employment opportunities and access to other amenities such as education, health care facilities to be extended to locals

Lease area is located in rural area. Local people will be employed in the mines. Jobs in the mines will generate employment opportunities in the area.

Provided fund, gratuity, Bonus to the employee will be provided as per statutory requirements.

Safety Welfare activities, besides personal protective equipment, training in safety, visit to various industries, group discussions, first aid kit and training etc will be taken up.

## X. MINE WASTES

### A. Mitigation Measures

#### 1) Land reclamation and mine closure plan

Systematic reclamation plan (in the form of afforestation, backfilling, water body etc.) will be organized towards the end of the mine. It will be seen that land becomes more useful than what it is today.

There is no intention to close the mining operations during the ensuring mining scheme period. It is a working mine and there are reserves for working of mine upto 7 years.

#### 2) Overburden dumps stabilization to minimize impact due to runoff

Grass will be grown on overburden dumps. Retaining walls of adequate dimensions () will be provided along the

periphery of overburden dumps in the south eastern side of sector -B within the mine to prevent wash off.

3) *Overburden utilization for back-filling and other purposes.*

Towards the end of life of mine dumps will be utilised for backfilling purpose.

4) *Municipal solid waste management in township*

Sewage from toilets and wash rooms shall be treated in septic tanks and soak pits.

5) *Measures to control runoff from waste dumps and mining surface*

Grass will be grown on overburden dumps and bench surfaces. Retaining walls of adequate dimensions will be provided along the boundary of dumps within the mine to prevent wash off from dumps.

6) *Hazardous waste management as per regulatory guidelines*

Mining will be done by opencast manual method. Blasting is avoided; instead rock breaker (jack hammer) is used. No explosives or any other chemicals will be used. Hence this clause is not applicable.

## XI. CONCLUSION

Mining of Iron ore is inevitable to fulfill the market demand of steel industries. This is also important to strengthen the representation of Nation in the International market. The proposal is made considering the current environmental regulations in order to minimize the impacts on the environment to help support sustainable development. The proposal design has considered socio economy as an important component. Hence, project will benefit to the society by implementing the Corporate Social Responsibilities (CSR) activities in a phased manner. This paper discusses the concepts of environmental impacts associated with mining methods. The environmental impact assessment of iron ore mining activity in Khursipar is very important and thus must be carried out at regular intervals. Hence, the unavoidable environmental problems are enumerated.

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