

Environment Management Plan of Khursipar Iron Ore Mine

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Abstract— The environmental management must be integrated into the process of mine planning so that ecological balance of the area is maintained and adverse effects are minimized. Environmental Management Plan (EMP) requires multidisciplinary approach. EMP can further be modified / upgraded time to time by taking advice from experts in the respective fields (forests, soil chemistry, ground water etc.), for the mining of minerals progresses. The changes warranted as per site specific conditions are to be accounted for during actual implementation. All phases of the project considering the impacts with mitigation measures and monitoring programme are covered by EMP. The plan outlines the measures that will be undertaken to ensure compliance with environmental legislations and to minimize adverse impact. EMP should essentially include monitoring programs and management control strategies for minimizing the adverse impacts: Air Pollution, Water Pollution, Noise, Vibration and fly rock during blasting, Biological reclamation measures, Land use planning and mine closure, Occupational Safety and Health, Socio-economic and cultural environment.

Key words: Environmental management plan, Land environment, Air Environment, Water Environment, Noise Environment, Biological environment, socio-economic and Health Environment, Mine Waste and mitigation measures

I. INTRODUCTION

A. Land Environment:

1) Geology:

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 km. presence of low grade (greenschist) metasedimentary rocks and volcanics such as those of Sakoli, Nandgaon and Kotri Dongargarh Groups in the south has been interpreted as an Island arc setting with probable subduction from the north to south.

2) Local 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 mounds/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 titanite magnetite 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 floural epidiorite, the gabbro with amphibolites dominates the western part. The titanite magnetite 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.

II. 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-titanite 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 undulated 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 comprises 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:

Table 1 shows the list of local variety of plants for plantation purpose based on following requirements the following specific requirements of the area. Species to be selected will fulfil:

- 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.
- 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.

Sr. No.	Botanical Name	Hindi Name
1	Delomix regia	Gul Mohar
2	Emblca officinalis	Amla
3	H. rosa sinensis	Jasut
4	Lxora arbprea	Nevari
5	Murava koenigii	Mitha Neem
6	Saraca indica	Asok
7	Syzygium cuminii	Jaman
8	Tamarindus indica	Imli
9	Eucalyptus	Nilgiri
10	Saraca asoca	Ashok
11	Delonix regia	Gulmohar
12	Mangifera indica	Mango
13	Tectona grandis Linn	Sag

Table 1:

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 northeasterly to easterly in the afternoon. 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 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 incase 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 is 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;

VI. 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 2:

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.
- The worked out slopes will be stabilized by planting appropriate shrub/grass species on the slopes. This will help in minimizing wash- off of Iron ore from these slopes; and
- The water table is found to be 26 meters from surface during monsoon period and recedes to a level of 30 meters form 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 - Mechanised), 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.

Period	Area in ha	Number of Saplings
I	0.5800	1450
II	0.2320	580
total	1.5359	3841

Table 3:

For five years 0.5800 Ha (7.5m safety barrier) will be covered by plantation. For balance period, 0.2320Ha will be used for plantation. The reclamation of mined out land is proposed, to be taken up from the last year of operations.

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

Mitigation measures:

A. 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.

B. 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.

C. Overburden utilization for back-filling and other purposes:

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

D. Municipal solid waste management in township:

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

E. 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. The worked out slopes will be stabilized by planting appropriate shrub/grass species on the slopes. This will help in preventing wash- off of Iron ore from these slopes; and

F. 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. ADDITIONAL STUDIES

A. Public consultation:

Company is having regular rapport with the local people and Pachayat. This includes various Social and non-Governmental organizations.

XII. RISK ASSESSMENT (RA) AND DISASTER MANAGEMENT PLAN (DMP):

A. Landslide:

Pit is shallow. Benches are formed with safe bench and pit parameters. Their height is 3m. Width is more than 5 meters. Slopes of the individual benches are also safe. There will be least chance of landslide.

B. Subsidence:

This is the case of open cast mining, Pit is also very shallow. There will not be any chances of subsidence.

C. Flood:

No major stream or channel is flowing in and around the lease area. There are two small ponds 270m away in the south eastern side and 560m away in the western side of lease. They are at much lower side and its highest level is also much lower. Bag River flows in the eastern direction ~ 11.93Km away. The mine site is much above the HFL of the river. There will not be any chances of flood.

D. Inundation:

Area experiences moderate rainfall which ranges from 1300 to 1500mm. Most of the rainwater seeps into the stratum. There will be least chances of inundation. There is good shelter in the lease as well as outside where people can be rescued during heavy rainfall or cloud burst.

E. Fire:

Mining will be carried out by non-mechanised manual method. Only trucks and tractors will make use of diesel for transportation. Though diesel is not highly inflammable there will be some chances of fire due to it.

F. Following precautions will be taken up:

- 1) Fuel and lubricants will be kept at safe place. Security guards will be placed to avoid any inadvertent entry.
- 2) Fire extinguishers will be placed at key places.
- 3) (These will be periodically refilled and maintained.
- 4) Workers will be trained in fire fighting.
- 5) Fire brigade department will be kept in day to day contact.

G. Seismic activities:

Area falls in category II of Seismic zones (least active zone). There will be least chances of earthquake.

H. Tailing dam failure

No wet processing will be carried out. There will not be generation of any tailings. This clause is not applicable. Proper disaster Management Plan will be prepared and got it approved from the competent authority. Once such plan is obtained, it will be submitted to the authority. Following is the name and address of the contact person in case of emergency.

XIII. PROJECT BENEFITS

Following shall be the benefits of the project:

- 1) This is a small industrial project in the rural area of the Gondia district.
- 2) Production of iron ore will help sustain steel based industries.
- 3) Employment opportunities will be generated in the rural area.
- 4) (iv) There may be development in the infrastructural facilities in the area due to this and group of mines.
- 5) Govt will get funds in the form of Royalty, sales tax, income tax, road tax etc.
- 6) (VI) there will be improvement in the living standard of the people due to increased income.
- 7) (vii) Contribution for CSR may improve the living style of people and development of natural resources Overall it can be said that the proposed project will have positive socio-economic impacts.

XIV. 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 socioeconomy as an important component. Hence, project will benefit to the society by implementing the Corporate Social Responsibilities (CSR) activities in a phased manner.

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