

EXECUTIVE SUMMARY

INTRODUCTION

Environmental Impact Assessment (EIA) is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision making tool, which guides the decision makers in taking appropriate decisions for proposed projects. EIA systematically examines both beneficial and adverse consequences of the proposed project and ensure that these impacts are taken into account during the project designing.

PROJECT DESCRIPTION

The Bauxite deposit in Pathrai village, Sitapur Tehsil, District Surguja falls in Mainpat plateau. The lease area of 99.350 Ha has been granted to M/s Chhattisgarh Mineral Development Corporation Ltd. (CMDC), Raipur.

The letter of intent for preparation of Mining Plan was issued by the State Govt. vide letter No. F-3-4/2007/12, dated 10/07/2013 and thereafter the same has now been extended further six months vide letter No. F-3-4/2007/12, dated 31/03/2014.

The area was earlier prospected by Directorate of Geology and Mining (DGM), during their field season 2005-06 & 2006-2007 (from Nov. 2005 to April 2007).

The peak capacity of the mines will be 2,00,000 TPA.

PROJECT PROPONENT

Chhattisgarh Mineral Development Corporation (CMDC), Raipur has been allotted Mining Lease (ML) at Pathrai village, Sitapur Tehsil, District Surguja of Chhattisgarh State.

LOCATION OF THE PROJECT

The proposed mine is located near village- Pathrai, Tehsil- Sitapur, District- Surguja, State- Chhattisgarh over an area of 99.350 ha.

ENVIRONMENTAL SENSITIVITY

Table E 1: Sensitive Locations in the Study Area (15 km. Radius)

Item	Name	Distances
Reserve Forest	RF Kadamdhadh	About 8 km in SSW direction.
	Mainpat RF	About 2 km in ESE direction
	Kamarta RF	About 2.2 km in SSW direction
	RF near Konchira	About 6.5 km in SW direction
	Pathkara PF	About 9.5 km in W direction
Barima RF		
Water Bodies	Sanguli Nadi	About 2.5 km in S direction.
	River Koerga	About 10.0 km in SW direction.
	Mahadev Manda River	About 12.0 km in SW direction.
	Barnai Nadi	About 12.0 km in NW direction.

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TOPOGRAPHY

In the regional topography, elevation of Mainpat Plateau is about 1060 m MSL. The highest elevation in the plateau is 1116 m to the north of Kamleshwarpur. The plateau extends about 40 kms in length towards east-west direction and about 14 kms in width towards north-south direction and is characterized by steep scarps along its edges. At places, these scarps are dissected by steep valleys which in certain places are up to 150 m deep.

The topography of the applied lease area is a dissected plateau and sloping towards southern direction. The lease area has been surveyed during prospecting by DGM on a scale of 1:4,000 with contour interval of one meter.

The applied lease area is a part of Mainpat Plateau, the highest elevation is 1098 mRL on the northern side and gradually sloping in all directions and lowest elevation is 1060 mRL towards southern side, the central part of the area is almost a flat land. About 38.203 Ha area is non-workable due to valley portions.

QUALITY OF RESERVES

The reserves and resources have been estimated as per the data given in the Prospecting Report. During prospecting the cut-off grade of bauxite is considered as Al₂O₃ minimum 40%, while for the preparation of this Mining Plan the reserve has been estimated as per the threshold value of Al₂O₃ 30% with reactive silica 5%.

151 boreholes and 3 pits are falling in the applied area but only 129 boreholes and 3 pits are showing the presence of bauxite ore and they have been considered for the reserve estimation. The spacing of boreholes having 40m interval in systematic grid pattern is considered for the ore reserve. The spacing of borehole/pit in influence area for that particular borehole/pit has been taken 20m on its either side and each borehole depth is also considered for the reserve calculation in **G-1 category**, based on this consideration, 20.217 Ha area is covered by detailed exploration.

Mineral reserve as per UNFC classification is presented in **Table E-2**

Table E-2: Mineral Reserves along with grade

Category	Area covered (Ha)	Resources (Tonnes)	Average grade		
			Al ₂ O ₃	SiO ₂	
Measured Mineral Resources	20.217	7,68,606	42.93	2.79	
Indicated Mineral Resources	4.410	1,65,135	43.21	2.74	
Inferred Mineral Resources	32.600	9,74,740	42.93	2.79	
Total	57.227	19,08,481	--	--	

Source: Mine Plan Prepared by Geo Solutions (P) Ltd

PROPOSED METHOD OF MINING

The mining operation will be carried out by open cast mining method, by deploying necessary mining equipments, thus, the mine will be comes under category "A".

The sequence of mining operations are as under:

- (i) The infrastructure facilities like office, rest shelter, maintenance shed, urinal etc will be provided before commencement of the mining operation.
- (ii) A smooth temporary haulage road of about 10 m width will be developed for movement of vehicles by using dozer.

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- (iii) The production will be carried out in influence areas of numbers of bore-holes simultaneously for obtaining the required quality of bauxite.
- (iv) Development by removal of top soil + laterite will be dozed off separately by deploying a dozer and stacked separately by excavator cum loader. The average height of the OB bench will be about 1.5 m (0.86 m top soil + 0.64 m laterite) with 45° slope.
- (v) After exposing the aluminous bauxite / bauxite zone and proper leveling by dozer for drilling and blasting, the drilling will be done by jack hammer of 32 mm diam for maximum 1.5 m depth and with DTH drills of 100 mm diam for more than 1.5 m depth of bauxite zone. Thereafter, blasting will be carried out after taking all safety measures/precautions. The bauxite mineralization is intermixed with clay, murrum and laterite.
- (vi) As per the actual practice in the other bauxite mines of the region, the recovery of graded bauxite is about 65% and remaining 35% will be generated as waste, hence the recovery of graded bauxite is considered as 65% of total bauxite zone and remaining 35% will be generated as waste.
- (vii) The sizing and sorting of bauxite to the marketable size of upto 150 mm will be done by manual labours.
- (viii) Thereafter, the marketable sized ROM will be loaded by 1.25 cum shovel into 10/15 T dumper/tipper to the consuming plants.
- (ix) The maximum depth of bauxite mineralization is confined to about 9.15 m (BH-N₃₁W₈) in the lease area.
- (x) Thereafter, the OB laterite and generated waste/rejects will be concurrently backfilled in the mined out pit and leveled.
- (xi) Finally, the back-filled leveled areas will be covered with top soil for plantation. For this, selected fast-growing types of special variety of plants in consultation with State pollution control board, Forest & Environment board will be grown and grounded after their full growth, thereby increasing the fertility of the soil and ultimately suitable for agriculture.
- (xii) Due to concurrently backfilled the mined out pit, the maintaining of OB and ore benches does not required.
- (xiii) Since, the production rate is high, the production has been proposed simultaneously from two or more quarries to meet the production target and required grade.
- (xiv) The proposed maximum production of saleable bauxite will be about 2,00,000 tonnes per annum.
- (xv) Bulk density of bauxite has been taken as 2.3, top soil 1.7 and laterite & waste is 2.0.

LAND ENVIRONMENT

MINE LEASE AREA

The entire lease hold area of 99.350 Ha lies in Chhote Jhad Ka Jungle land. The break-up of the land use of mining lease area is given below in **Table E.2**

Table E 2:- Land Use Pattern of the Mining Area (in Ha)

S. No.	Description	Area (Ha)		
		Present Land	End of the 5 year	conceptual period
1	Area under Pits	-----	6.86	-----
2	Water Reservoir	-----	-----	7.08

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3	Area backfilled	-----	13.48	13.95
4	Area under roads	0.45	1.10	1.10
5	Area under Infrastructure	-----	0.15	0.15
6	Area under Plantation	----	5.00	5.00
7	Unused Area	98.9	73.21	72.07
	Total	99.350	99.350	99.350

Source: Mine Plan Prepared by Geo Solutions (P) Ltd

ANALYSIS OF ALTERNATIVES

In the proposed project, opencast mechanized mining method will be carried out. For that, no other methodology is going to be changed, depending upon the geological set up, strata of the rock, boulders and its structural behaviour. So, all the parameters of REIA/ EMP will be implemented as per the open cast mechanized mining.

DESCRIPTION OF ENVIRONMENT

This section contains the description of baseline studies of the 10-km radius of the area surrounding the site. The data collected has been used to understand the existing environment scenario around the proposed mining project against which the potential impacts of the project can be assessed.

Baseline data was generated for various environmental parameters including air, water (surface and ground water), land and soil, ecology and socio-economic status to determine quality of the prevailing environmental settings. The baseline data for study was conducted during post-monsoon (March to May, 2015) season.

METEOROLOGICAL DATA

This section makes a comparative analysis of the meteorological condition of the study area. The data used for the purpose are the last 30 years average IMD data and the on-site data recorded during the period March to May 2015.

The study area is part of tropical monsoon climate with long humid summer and short winters. The rainfall is heavy during monsoon and light in pre monsoon season.

The annual average total rainfall recorded in the region was found to be 1526.9 mm, which is quite high. The maximum average rainfall (460.9 mm) was recorded in the month of July. This month also had the maximum number of rainy days.

The average maximum temperature was recorded in the month of May at 39.5°C and the minimum temperature was 8.8°C in December. The highest temperature recorded in the area was 44.9°C in June 1988 while the minimum was 0.9°C in January 1989.

The Relative Humidity was highest during the monsoon season with the month of August recording the highest average at 88%.

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The maximum average wind speed was found to be 7.8 kmph in the month of June. The predominant wind direction recorded at the IMD station was from North followed by South-west and West.

AIR ENVIRONMENT

Nine Ambient Air Quality Monitoring (AAQM) Stations were selected. Criteria used for designing the network were principally governed by the wind rose pattern for pre-monsoon seasons and the accessibility of the selected sites. The value of parameters at all the location is found within the limits prescribed by Central Pollution Control Board (CPCB). The 95th percentile value of SPM varies between 81.1 g/m³ at Paiga Village to 113.4 g/m³ at Kuniya. PM₁₀ recorded within the study area was in the range of 47.0 µg/m³ to 59.5 µg/m³ with the 95th percentile. The 95th percentile concentration of PM 2.5 varies between 17.3 µg/m³ to 29.9 µg/m³. The values were found well below the National Ambient Air Quality Standards (NAAQS) of 60 µg/m³ for PM_{2.5}. SO₂ recorded within the study area was the 95th percentile ranging between 7.9 µg/m³ to 12.8 µg/m³. NO_x recorded within the study area was with the 95th percentile ranging between 12.5 µg/m³ to 17.4 µg/m³. CO recorded within the study area was with the 95th percentile ranging between 0.91 mg/m³ to 1.39 mg/m³.

NOISE ENVIRONMENT

The noise level in area varies from 49.3 dB (A) to 53.6 dB (A) during day time and 35.9 dB (A) to 36.6 dB (A) during night time. Traffic movement was found due to the vehicular movement & mining activities in nearby areas. In general, Noise level in study area was found well below to the standards.

WATER ENVIRONMENT

DRAINAGE PATTERN OF MINE LEASE AREA

Streams of the plateau exhibit a combination radial and dendritic pattern. Major streams near the ML area are flowing towards north direction and joined to Mangarda Nala which is flowing towards Eastern direction. No perennial nala is flowing within the lease area. There are some first order streams starting from the western boundary of ML area and flowing in west and north direction. These nalas will not be affected by mining operations.

In the buffer zone there are two rivers, viz. Ghagil Nala and Gungata Nala which flows 8km E and 100m S from the ML area. Jaijhala Nala and Johi Nala flows 1km NW and 7km NNE from the ML area. Koerga Nadi and Manchai Nala flows 1.8km WSW and 5.7 km NW from the ML area. There are some major static water bodies which act as source of water for the local population during the monsoon and post-monsoon seasons.

WATER QUALITY

Three surface water and four ground water samples were collected and tested to know the water quality of study area. The water quality of the water samples collected were analysed and found well within the desirable limits as per IS: 2296 Class C & IS: 10500:2012.

The colour and turbidity of the samples were normal. The Dissolved Oxygen was found between 4.2 and 5.5mg/l which are good for survival of aquatic life. Total Dissolved Solid was 252 mg/l which is within the maximum permissible limit of 1500 mg/l.

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Chlorides, sulphates and fluoride concentration of the samples were well below the permissible limits. The alkaline earth metal like calcium and magnesium concentrations were of the range 11.9 to 22.3mg/l and 12.7 to 17.3 mg/l respectively. Biological contamination of surface water bodies were observed due to stagnant nature of water bodies. The heavy metals were found to be below detectable limits.

In general, the water quality of the sampling location was found complying acceptable tolerance limits as per IS: 2296 Class C considering the concentrations of relevant parameters and can be used for drinking purpose after conventional treatment.

SOIL QUALITY

To understand the soil quality in the proposed study area, 7 locations were selected for soil sampling. Composite sampling of soil up to root depth (10-15 cm) was carried out at each location. The important properties of soil are bulk density, porosity, infiltration rate, pH and organic matter, kjeldahl nitrogen, phosphorous and potassium.

BIOLOGICAL ENVIRONMENT

FLORA

On the basis of distribution of flora and fauna, the study area is demarcated into agricultural land, terrestrial vegetation, forest land, and water bodies. The project site is an open scrub land devoid of thick vegetation.

The common trees observed in the study area and in the reserved forests in the study area are Babul, Haldi, Banana, Tendu, Bael, Amla, Shishom, Khair, Aam, Bila, Sal, Champa, Teak, Pakri, Kekad, Koriya, etc.

FAUNA

The mine lease area is scantily vegetated and the area is devoid of significant faunal existence. As the animal species are capable of moving from place to place either for food or shelter or mating, hence, the common check list is prepared based mainly on available secondary data and also on the basis of direct observation, indirect or circumstantial evidence such as foot and scratch marks, feathers, skin etc.

A primary field survey was conducted through random observation in the study area and data was also collected from local persons of the area and forest officials. The common mammals observed in the study area and in the reserved forests in the study area are jackal, squirrel, fruit bat, field rat, elephant, Bengal monkey, barking deer, panthar, jungle cat etc. The common birds observed in the study area are common myna, house crow, spotted dove, jangali tota etc.

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

IMPACT ON AMBIENT AIR QUALITY

The mining is proposed to be carried out by opencast mechanized method. The air borne particulate matter generated by ore and handling operations, transportation and screening of ore is the main air pollutant. The emissions of Sulphur dioxide (SO₂), Oxides of Nitrogen (NO_x) contributed by vehicles plying on haul roads are marginal. Prediction of impacts on air environment has been carried out taking into consideration proposed production and net increase in emissions.

The maximum incremental ground level concentration of SPM will be 0.623 µg/m³ near the project site. This shows that the adverse impact of mining outside the ML area will be marginal and will not have any adverse effect on health of human and animals and also on the flora of the

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area. For PM10 the incremental value is $0.311\mu\text{g}/\text{m}^3$ and there will be no major impact on the environment

MITIGATION MEASURES FOR AIR POLLUTION

Bauxite is a hydrated oxide of aluminum. It is a mixture of two or more hydroxides corresponding to Gibbsite ($\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$) and Boehmite ($\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$). The moisture content in Bauxite is around 3% to 7%. Therefore, emissions due to mineral handling, during mining operations are not much and restricted to the lease area only. Air pollution is caused mainly due to dust generation added with gaseous emission from transportation activities along with mining operation like loading etc.

CONTROL OF FUGITIVE EMISSION

- Use of Personal Protection Equipment (PPE) like dust masks, ear plugs etc by the mine workers.
- Regular Water sprinkling on haul roads & loading points will be carried out.
- Development of green belt/plantation around the lease boundary, roads, dumps etc should be developed.
- Ambient Air Quality Monitoring conducted on regularly basis to assess the quality of ambient air.

PRESERVATION AND CONTROL OF GASEOUS POLLUTION

- In mining activities, the sources of gaseous emissions would be vehicle movements.
- Proper maintenance of machines improves combustion process & makes reduction in the pollution. Good maintenance and monitoring of fuel and oil will not allow significant addition in the gaseous emission.

IMPACT ON NOISE LEVEL

Noise generated at the mine is due to truck transportation activities. The noises generated by the mining activity will dissipate within the mine. There may be noise pollution due to drilling, blasting and movement of trucks. This may go beyond the threshold value i.e. 90dB (A), but will be momentary. No major impact of the mining activity on the nearby villages is envisaged. The pronounced effect of noise will be felt only near the active working area.

The impact of noise on the villages is negligible as the villages are located far from the proposed mine lease area or mine workings. Since there is no involvement of major machinery, the impact of noise levels will be minimal.

MITIGATION MEASURES FOR NOISE POLLUTION

The following mitigation measures are suggested for water management and water pollution control. However, priority relevance depends on the location and type of mining and minerals.

- Garland drains will be constructed on all side of quarries and external dumps. All the garland drains will be routed through adequately sized settling pits to remove suspended solids from flowing into storm water drains. The design of settling pits would be calculated on the basis of silt loading, slope and detention time required.
- The vehicle washing and maintenance wastewater will be suitably treated for suspended solids and oil & grease.

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WATER CONSERVATION MEASURE

The rain collected in the pits after spell of rain will be used for plantation and dust suppression. At the end of life of mine, excavated area will be used as a rain water pit.

IMPACT ON FLORA & FAUNA

The impact on biodiversity is usually very high if the project is located close to ecologically sensitive areas such as forests. However in this case, the proposed mine lease area is away from any type of sensitive area. The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics. Mine site preparation and construction of roads for providing access to the mining site will involve removal of vegetation cover which may impact the biodiversity of the area.

The impact on terrestrial ecology will be due to emission of gaseous pollutant like NO_x from vehicles. The pollutant at a very low dose acts as an atmospheric fertilizer for the vegetation. However, at higher doses, they are injurious to both vegetation as well as animals. For the mining operations, NO_x emissions are mainly due to burning of diesel in mining vehicles. As described in the baseline on air quality, the low concentrations of NO_x due to operation of the mining operations will have insignificant impact on ambient air quality and NO_x concentration will remain much below the NAAQ standards. Therefore, the impact of these emissions on the surrounding agro-ecosystem will be insignificant.

SOCIAL ENVIRONMENT

The mine area does not cover any habitation. Hence the mining activity does not involve any displacement of human settlement. No public buildings, places, monuments etc exist within the lease area or in the vicinity. The mining operation will not disturb/ relocate any village or need resettlement. Thus no adverse impact is anticipated.

The impact of mining activity in the area is positive on the socio-economic environment of the region. The negative impact will be limited to some sporadic health problems, which may occur due to increase in fugitive emission in the vicinity of the mines. The proposed mine project is providing employment to local population and it will be give preference to the local people whenever there is requirement of man power. The local skilled labour will have additional opportunity to enter into automobile maintenance profession to cater to the needs of the transport trucks.

OCCUPATIONAL HEALTH & SAFETY

External hazards involve injuries to human cattle and plants, which could occur during mining operations. These injuries could be due to flying stones and also when ore transport vehicle loses control, internal hazards occur due to unhygienic work conditions or carelessness of the workers involved in mining operations. Internal hazards often show their affect after a long time.

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The mining operation is unlikely to cause any adverse impact due to the above factors in buffer zone. The mine management will provide proper health care facilities near the mine area. This will be provided to the surrounding villages in case of emergencies. All measures to provide a safe environment will be taken by the management. The speed of dumpers/trucks will be regulated inside and outside the mines to ensure safety of employees as well as locals. Hence adverse impact on health and safety of the workers and the local population is not expected. No accident or injury due to fly rock is expected in the mine or due to this mine.

ANTICIPATED IMPACTS AND MITIGATION MEASURES

Environmental impact assessment (EIA) of the proposed project has been carried out with reference to air, soil, water, noise, flora, fauna and socio economic.

POST-MONITORING PLAN

To evaluate the effectiveness of Environment Management Programme, regular monitoring of the important environmental parameters will be taken up. The schedule, duration, and parameters to be monitored are shown in **Table E.3**.

Table E 3: Monitoring Schedule and Parameters

Sl. No.	Description of Parameters	Schedule and Duration of Monitoring
1	Air Quality (SPM, PM10, PM2.5, SO ₂ , NO _x) monitoring in five locations <ul style="list-style-type: none">In the pit office/workshopTwo monitoring station in up windTwo in downwind in consultation with SPCB	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms.
2	Continuous micro-meteorological monitoring in one location <ul style="list-style-type: none">On roof of nearby building	Continuous
3	Water Quality of surface and ground water around the site will be collected from 6 (3 for each) locations in consultation with SPCB <ul style="list-style-type: none">One of the locations will be in near the OB DumpOne near the active working areaOne near the natural discharge point	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms
4	Ambient Noise Level monitoring in consultation with SPCB <ul style="list-style-type: none">Near the pit head	Will be monitored in every quarter as per norms laid down under MCDR 1988 and DGMS norms
5	Inventory of flora to judge the comparative status will be done in the nearest forest	Once in 2 years
6	Soil <ul style="list-style-type: none">One of the locations will be near OB DumpOne near the active working area	Twice in a year in reclaimed land
7.	Biological <ul style="list-style-type: none">Green Belt developmentBlock PlantationReclaimed Area PlantationHydro ReclamationWater harvesting Schemes	Every 6 months by a core group formed from management and plantation executing agency

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BUDGETARY PROVISION FOR ENVIRONMENT PROTECTION

The capital cost estimated to be incurred for environment care and protection such as equipment; PPEs, etc will be Rs 3.0 lacs. The recurring cost for monitoring, dust suppression, green belt maintenance, and biological reclamation of land has been calculated at Rs 9.5 lacs annually.

CONCLUSION

As discussed, it is safe to say that the proposed facilities are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from the premises of "Pathrai Bauxite Mining Project.